The Bobwhite Quail

and its

Management in Florida

Robert W. Murray and O. E. Frye, Jr.

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THE BOBWHITE QUAIL AND ITS MANAGEMENT IN FLORIDA

By

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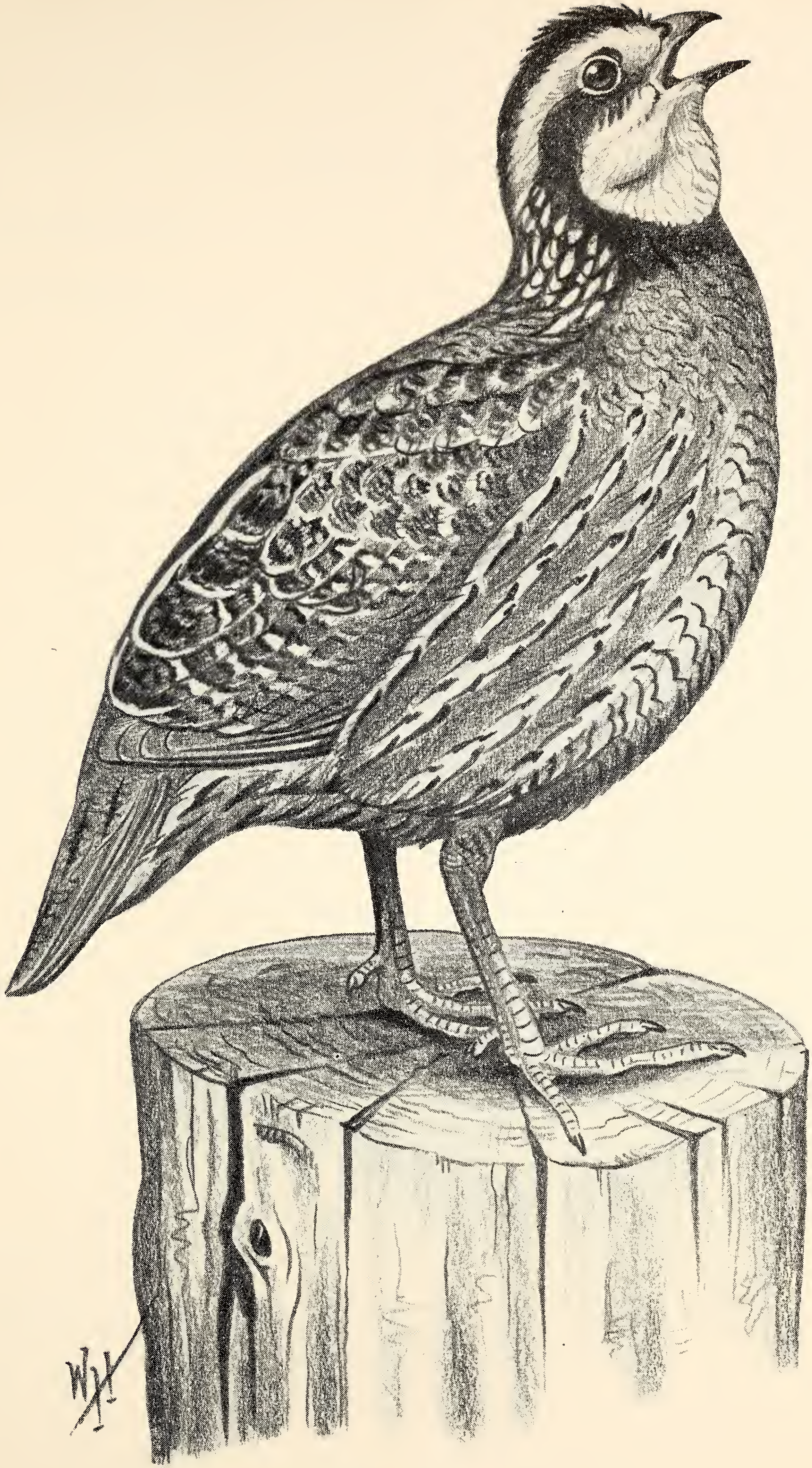
FOREWORD

This bulletin is written for all who have an interest in Florida's most important upland game bird, the bobwhite quail. The landowner, hunter, and nature lover will find here discussed the factors which control our quail populations and explanations of the ways by which these populations may be maintained and increased. We strongly feel that the information here summarized and presented can enable all of us to have a better understanding of this excellent game bird. All game species produced in the wild are products of the land, their welfare dependent on general land use practices. Fortunately, the bobwhite quail responds well to favorable land management and habitat improvement. Perhaps more than in the case of any other game bird, the status of our quail population depends upon the individual landowners, and upon their programs of land management.

It is evident that the rapid increase in Florida's human population, and the resulting increase in hunting pressure, make it necessary that every means be employed to increase the carrying capacity of our quail range. We hope this bulletin will stimulate the incentive and provide the information to insure continued good quail populations in Florida.

A. D. ALDRICH, Director
Florida Game & Fresh Water Fish Commission



The Bobwhite Quail—Florida's Premier Game Bird.

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Acknowledgments

The authors wish to express appreciation to the fellow workers, sportsmen, landowners, and other interested persons who have contributed quail crops and wings and other valuable material for the gathering of scientific data. Through their assistance the publication of this bulletin is made possible.

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THE BOBWHITE QUAIL AND ITS MANAGEMENT IN FLORIDA

Introduction

Every year more and more of Florida's land is being put to work to produce something. This is the direct result of an ever-increasing human population. At present an average of 1,000 families per week are moving into Florida. The new businesses and industries that are accompanying this increase in population are expanding at the expense of our remaining wildlife land. Whether the business is an improved pasture, an orange grove, or a tourist court, it encroaches upon our frontier wildlife land much as a flood engulfs inch by inch the opposing hillside.

If we are to maintain quail and other wildlife populations, we must bring ourselves to realize that this flood is not likely to recede, or even discontinue its advance. We must improve the quality of the remaining land for wildlife if we are to keep the same quantity of wildlife. Land that once supported one quail per twenty acres will have to be managed to support one quail per ten acres if half of that land is taken out of quail production. This is simple arithmetic.

As the population increases in Florida, so do the hunters. Sales of hunting licenses have increased by 85 per cent during the last decade (1946-1956). Many tourists visit our State every hunting season to indulge in that traditionally fine sport of the South, quail shooting. Many of the people who are coming to Florida to retire look forward to quail shooting. To maintain present numbers of quail is not enough; there has to be an increase to correspond with the increase in number of guns. So, we are face to face with the problem of how to increase our quail on an ever-diminishing range.

The objective of this publication is to assist those who wish to develop and manage land for quail. Quail management is no longer a difficult and perplexing problem. This game bird has been under scientific study long enough so that its management in the South can be prescribed by a few well-defined rules. These rules are set forth in the pages which follow. We appeal to all agencies and institutions, federal, state, county, and urban; to all organizations and enterprises, private and cooperative, to assist in the management of the South's greatest game bird, the bobwhite quail. The Game and Fresh Water Fish Commission cannot do the job alone. This endeavor is too great in scope. There must be combined interest and effort.

LIFE HISTORY

Before we can attempt management of any game animal we must first understand the life history of that animal and its patterns of reproduction. The life history of the bobwhite quail has been carefully and thoroughly studied by many investigators. One of the most complete studies in the country was done by Mr. Herbert L. Stoddard (1931) working on the game plantations of the Thomasville-Tallahassee area. His book, *The Bobwhite Quail, Its Habits, Preservation and Increase,* has served as a guide for men working in the quail management field. Those desiring to gain a thorough knowledge of the bird should procure this magnificent treatise.

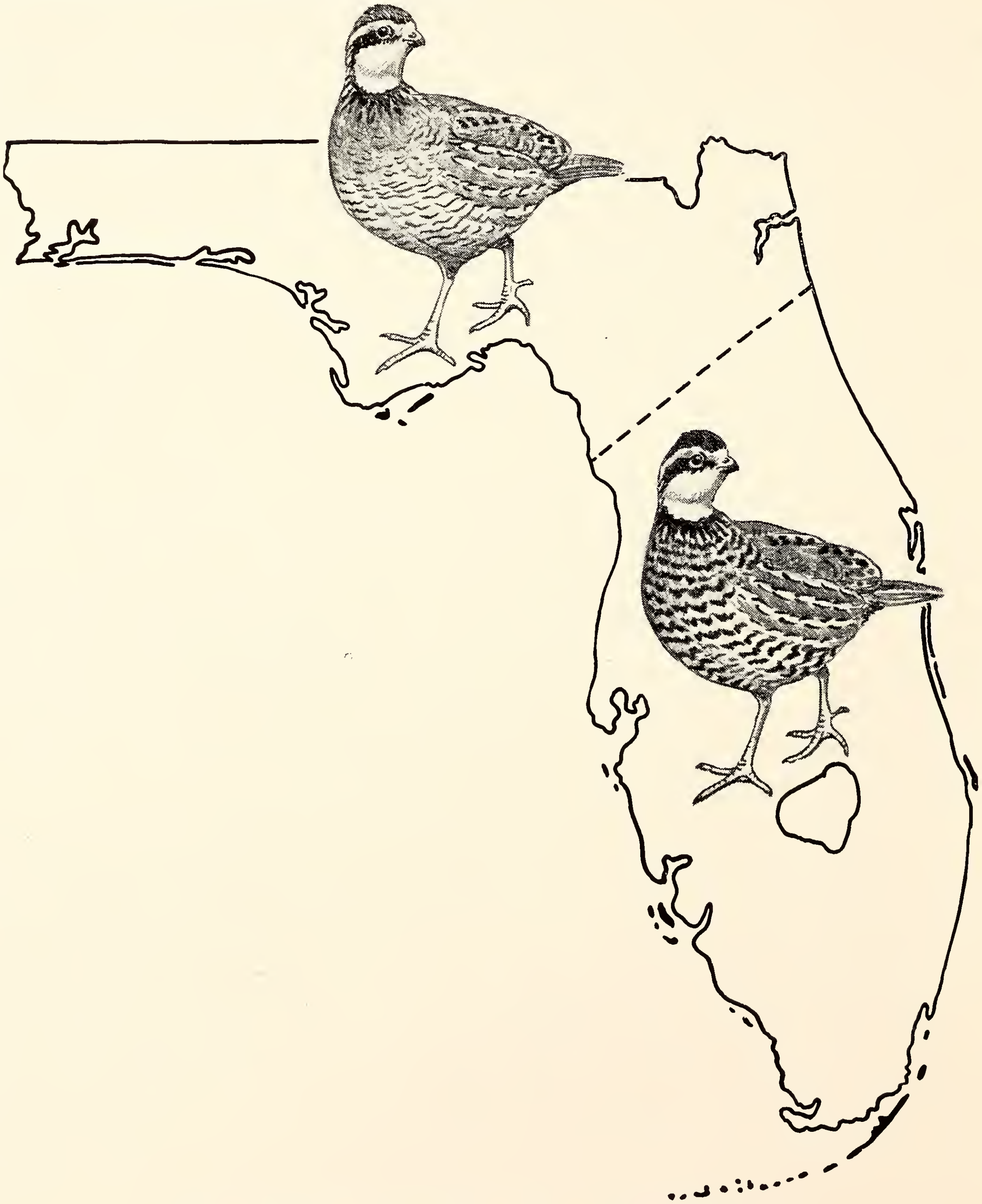

Figure 1. Range of the Eastern and Florida Bobwhites.

There are two subspecies of quail in Florida, the eastern bobwhite, *Colinus virginianus virginianus* (L.) of north Florida, and the Florida bobwhite, *Colinus virginianus floridanus* (Coues) of south Florida. The latter is considerably smaller and darker than the former. The eastern bobwhite will average around six ounces in weight, whereas its southern cousin averages around five ounces. Figure 1 shows the range of each bird in Florida. There is considerable overlap in the ranges and the birds intermix freely where they both frequent the same range. The life history of both birds is essentially the same. Habits and behavior throughout the year are reviewed here briefly.

Covey Breakup

Covey breakup is a rather gradual activity in the spring. Its first indication is an increasing belligerence, especially on the part of the males, to other birds of the same sex. Birds that live together in perfect harmony during the winter become quarrelsome. There is a great deal of usually harmless sparring. As courtship begins in earnest, pairs or trios begin to wander away in the warm days of early spring, only to reassemble in coveys at night to roost. In north Florida, covey breakup usually begins around March 15, but may not be complete with some coveys until May 1. In the southern part of the state it can be expected to occur three or four weeks earlier. The association loosens as the days grow longer until the covey organization is completely dissolved. There is no evidence to support the sometimes common belief that there will be no covey breakup in the spring if no birds are shot from that covey in the winter.

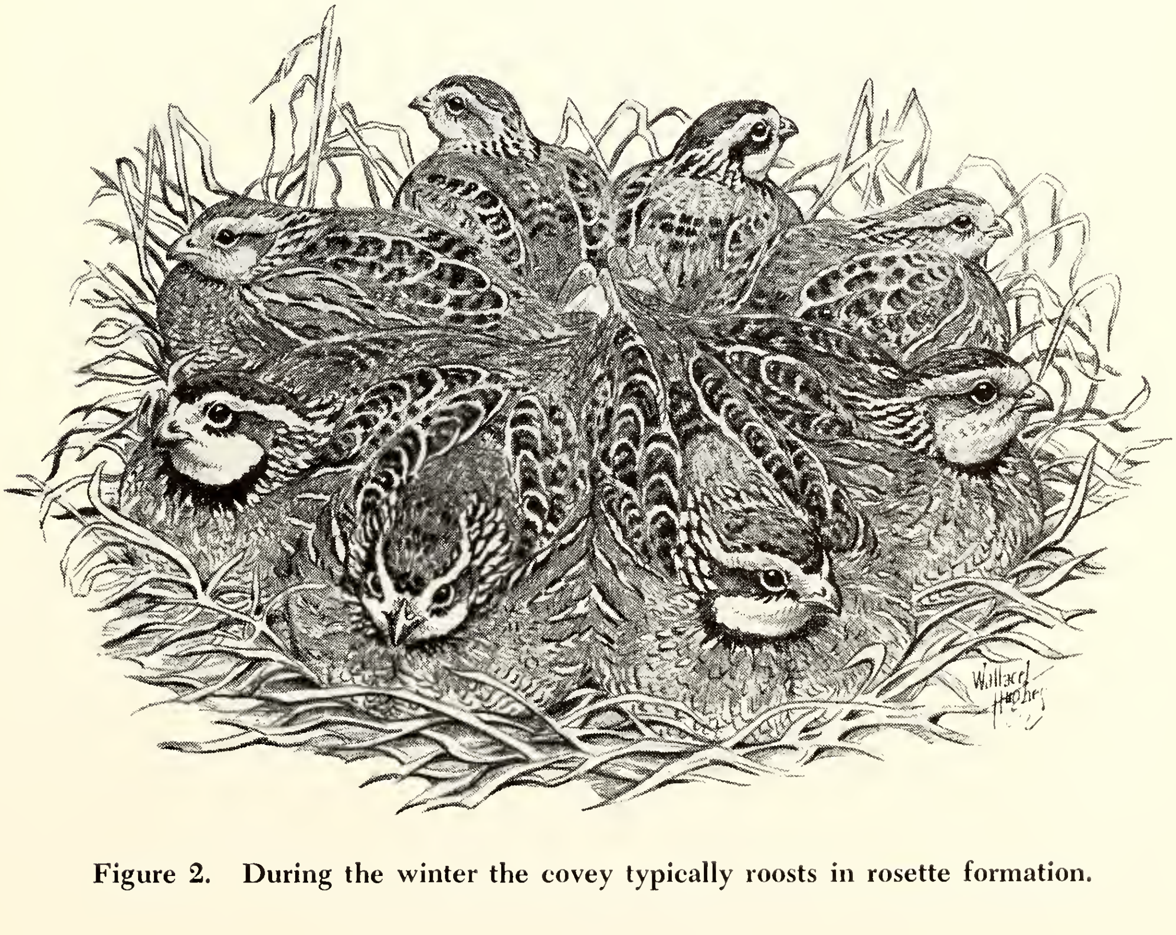

Figure 2. During the winter the covey typically roosts in rosette formation.

Pairing

Most of the birds have paired and mated by the time the covey breakup is complete. The mated as well as the unmated are now able and are sometimes forced by the aggressiveness of their erstwhile covey associates to leave their winter range. Food and cover have become more abundant with the spring growth of vegetation and insects. Territory that may have been uninhabitable during the winter is no longer bare and the whole countryside constitutes the summer or breeding range of the birds. The "*bob-white*" calls of the cocks that were unmated by the time the coveys broke up come from everywhere. These "bachelor" cocks are doomed to a lonely summer since there are not enough hens to go around. There are normally approximately 15 per cent more cocks than hens at the time the coveys break up. However, these lonely cocks are persistent and continue to whistle into the summer. Whistling apparently reaches a peak in June. The bobwhite is a monogamous bird. Once mated he remains a devoted husband and father until nesting is completed and the chicks reared.

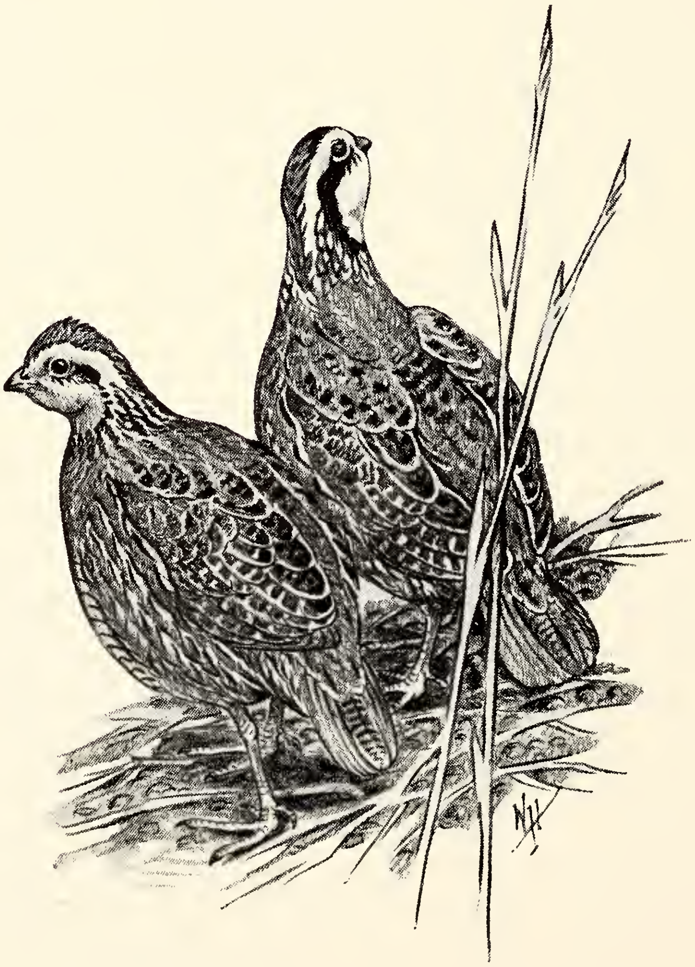

Figure 3. In early spring pairs form as the covey breaks up.

Nesting and Incubation

As much as a month may lapse between the time of pairing and nest construction. During this time the pair is inseparable, with the hen usually taking the lead in routine activities and the cock following. Once a desirable site for the nest is found, both birds share in the construction duties. Most nests are made near paths, roads, or small clearings under a tuft of grass or other overhanging ground vegetation which, together with the partial roof usually constructed by the birds, renders the nest very difficult to see. The hen normally begins egg deposition as soon as the nest is completed. It takes her from 15 to 20 days to lay the average clutch of 14 eggs. During this time she is only on the nest long enough to lay. The remainder of the time is spent with the cock who has remained nearby. The pair forage, dust, and loaf together. Soon after the last egg is deposited, incubation begins. This duty, although usually performed by the hen, may be shared by the cock. If the hen is killed while incubating, the cock completes the task. By the twenty-third day after incubation begins, the chicks have emerged from the shell. The nesting season in north Florida runs approximately from May 1 to October 1, with the peak being normally in June and July. In south Florida nesting is two to four weeks earlier. If the first eggs are destroyed the birds will continue to renest until late in the summer or until they are successful in bringing off a brood. The number of eggs produced at later nestings becomes progressively smaller. Under normal conditions about 85 per cent of the eggs hatch. If the weather is exceedingly dry and hot,

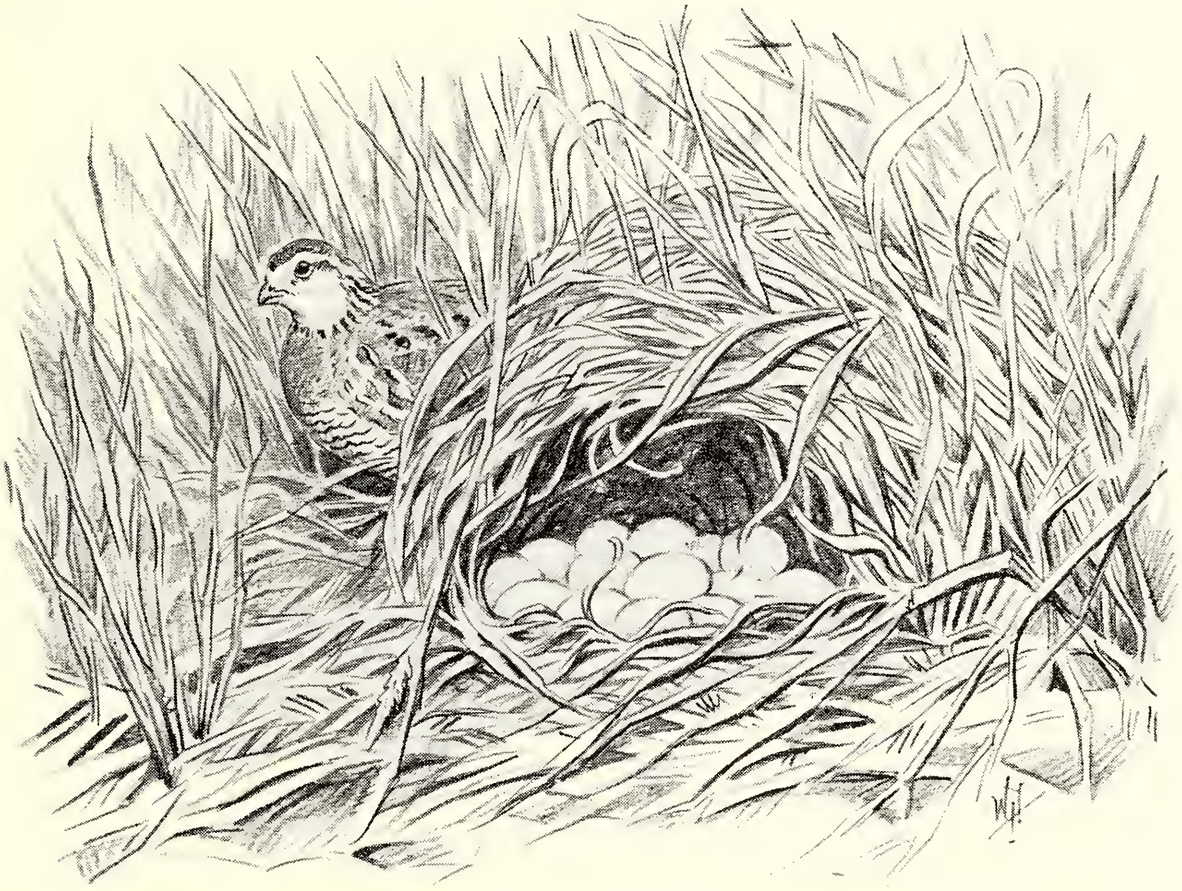

Figure 4. The nest is usually placed on the ground beneath a tuft of grass.

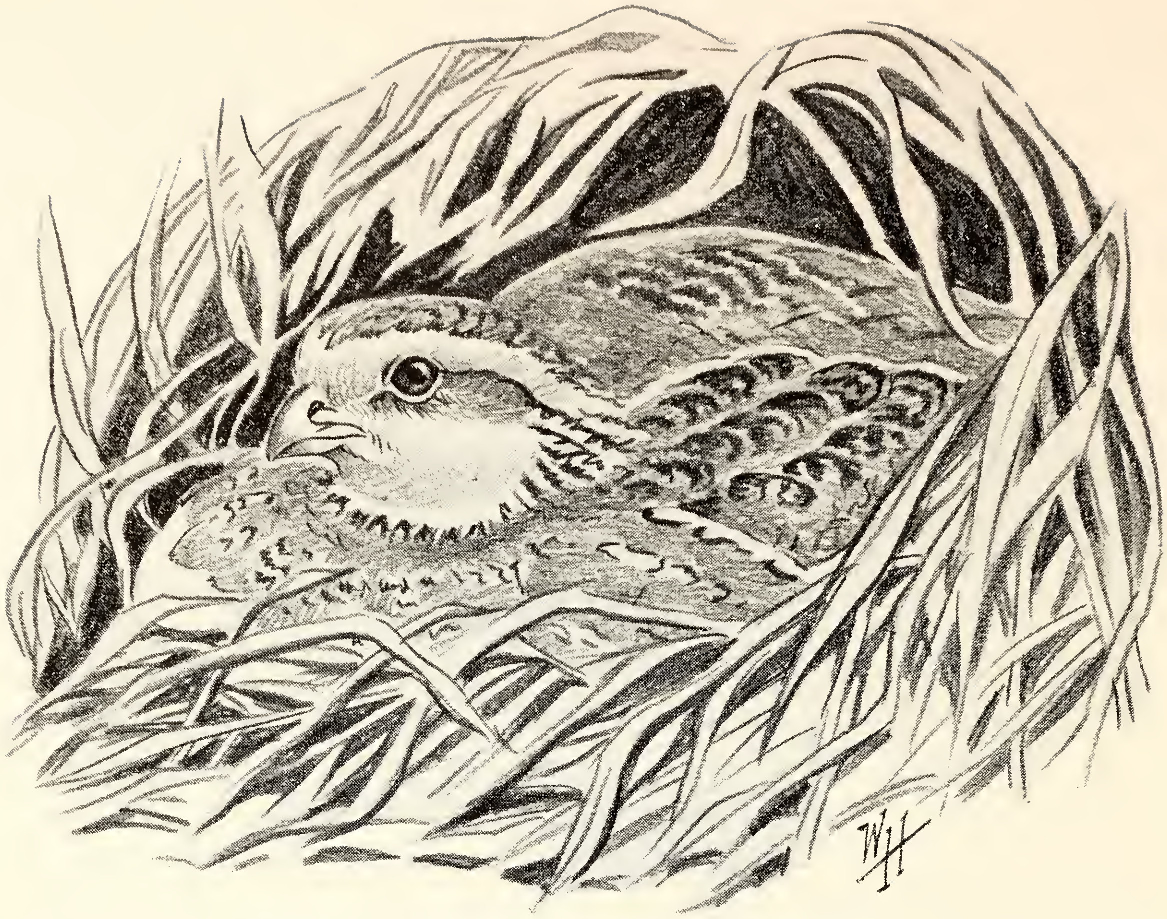

Figure 5. Incubation is usually done by the hen.

the ground temperature is high and there is little soil moisture. This condition usually results in poor hatches. If the ground temperature is high enough to kill the embryos none of the eggs may hatch, in which case the hen may incubate until she is physically unable to renest. However, if only one egg hatches the nesting instinct is satisfied and the activity complete for the year. There is no evidence to support the common belief that more than one brood is raised each year. This belief stems from frequent observations of newly hatched quail in the late summer or young of different ages in a single brood. The late broods are the result of renesting after earlier failure. The occurrence of different aged young together merely reflects the natural gregariousness of quail. Poor egg hatching is a primary cause of poor quail crops in drought years.

There are many natural enemies of the nesting quail. Among the worst are skunks, cotton rats, snakes, and ants. Stoddard (1931) described fire ants eating the chicks as soon as the egg shell was punctured and emergence began. In his study of 602 nests he found that 37 per cent were destroyed by natural enemies. Sixty-four per cent of his nests were failures, leaving only 36 per cent to hatch successfully. Twenty per cent of the nests were deserted due to disturbance by the elements, man, livestock, and other sources. Nevertheless, in view of the readiness with which quail renest and the fact that a given habitat will support only a given number of birds, it is extremely doubtful that normal nesting losses due to predation have an appreciable effect on the number of birds starting the hunting season.

Figure 6. Some nests are lost to predation but renesting usually occurs.

Rearing

The old birds lead the young from the nest just as soon as hatching is completed. If the nest contained an average clutch of 14 eggs and the hatch was normal, 12 to 14 young birds leave the nest. Both parents share in the duties of rearing and brooding the young. Either will carry out this assignment alone in the event of the death of the other. During the first two weeks the chicks require much brooding. At the time of hatching they are covered with natal down and weigh about one-fourth ounce. When one week old they weigh about one-third ounce and specks of juvenile plumage appear on the wings. At two weeks they weigh one-half ounce and the juvenile plumage has progressed to the sides and shoulders. They are now able to fly short distances. At three weeks they weigh almost an ounce and juvenile plumage has come out on the breast and back. At four weeks the weight has reached one and one-half ounces. Most of the natal down has been lost except on the head. The first juvenile primary wing feather is shed. The second is shed at five weeks. At six weeks they weigh approximately two ounces and juvenile plumage is practically complete. The third juvenile primary is dropped and the first and second adult primaries are coming in. They appear almost half the size of the old birds. At eight weeks they weigh almost three ounces and are in full juvenile plumage with adult feathers beginning to appear on the breast. The fifth juvenile primary is dropped and the fourth adult primary, which was dropped at seven weeks, is coming in. At ten weeks they weigh four ounces and appear almost grown.

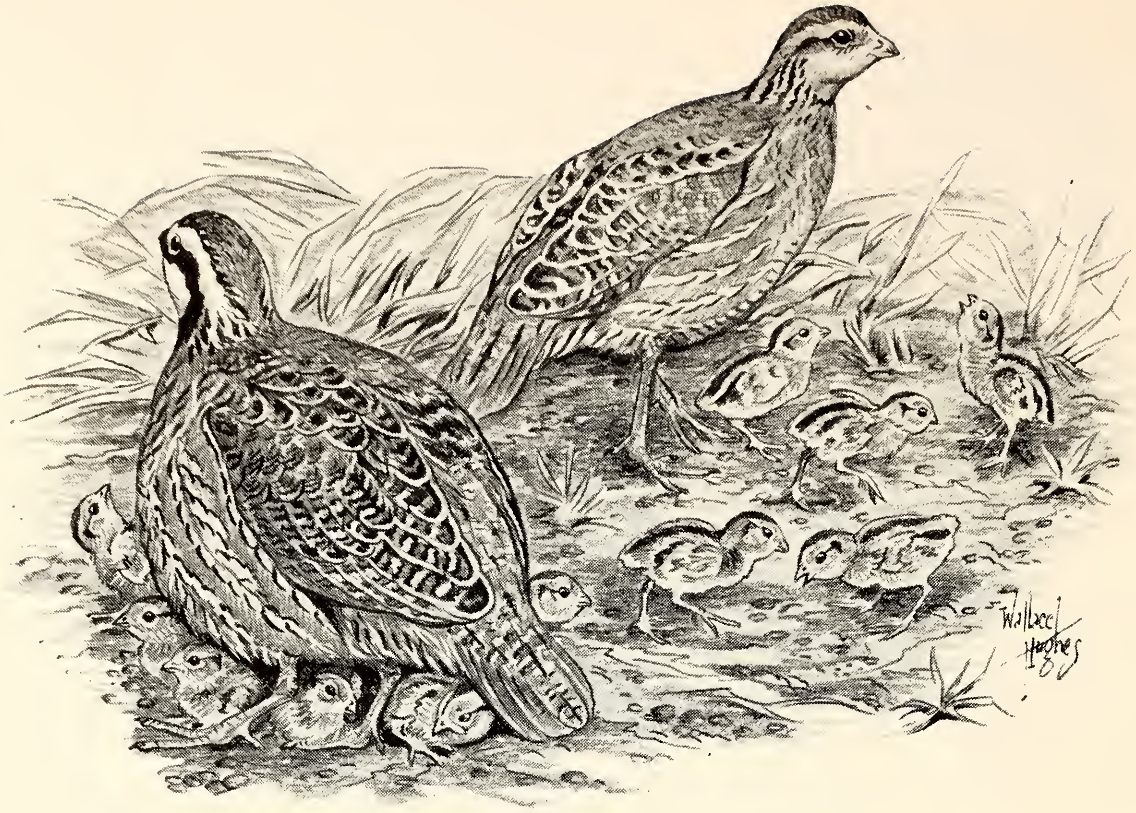

Figure 7. Both parents take part in rearing the young.

Most of the juvenile plumage has been replaced by adult plumage and the distinguishing sex markings become apparent. The sixth juvenile primary has been dropped and the adult number five primary is coming in. At twelve weeks the birds weigh approximately four and three-fourth ounces and are difficult to tell from the old birds at a distance. Adult plumage predominates and the seventh adult primary is coming in. They are no longer dependent upon the old birds. At 15 weeks they are practically indistinguishable from the adult birds and weigh approximately five and one-half ounces. The eighth juvenile primary has been shed and they are now mature birds. In north Florida the two remaining juvenile pointed primaries (9 and 10) will not normally be shed and replaced by the round-tipped adult feathers until the moult the following summer. However, if the hatch was early the ninth primary may be shed. In south Florida a large percentage of the earlier hatched birds moult the ninth primary and a few moult the tenth in their first year.

By the time the birds are 16 weeks old it is the middle of October, assuming that they hatched around July 1. They are grown birds and behave as a well coordinated unit or covey. They roost in typical rosette formation for mutual warmth and protection. The whole covey "freezes" as one or flushes as one. Their diet now consists to a great extent of seeds and grains which have become increasingly available. During the summer they had ranged over fifty or sixty acres in their foraging activities. They had had little need for surface water to drink, obtaining moisture from dew drops and succulent berries and insects. Quail do not need surface water to thrive except in case of a prolonged drought when there is no dewfall. At such times they may move to a source of surface water.

A typical brood during the summer has not gone without mortality. Perhaps five of an original thirteen young had perished, leaving eight young and the two parent birds in the family group. A foraging cow had stepped on one when three days old. At two weeks of age a house cat had pounced upon the group and one did not escape. Another chilled to death after being exposed to cold drizzling rain one night after they were scattered by a stray dog. At seven

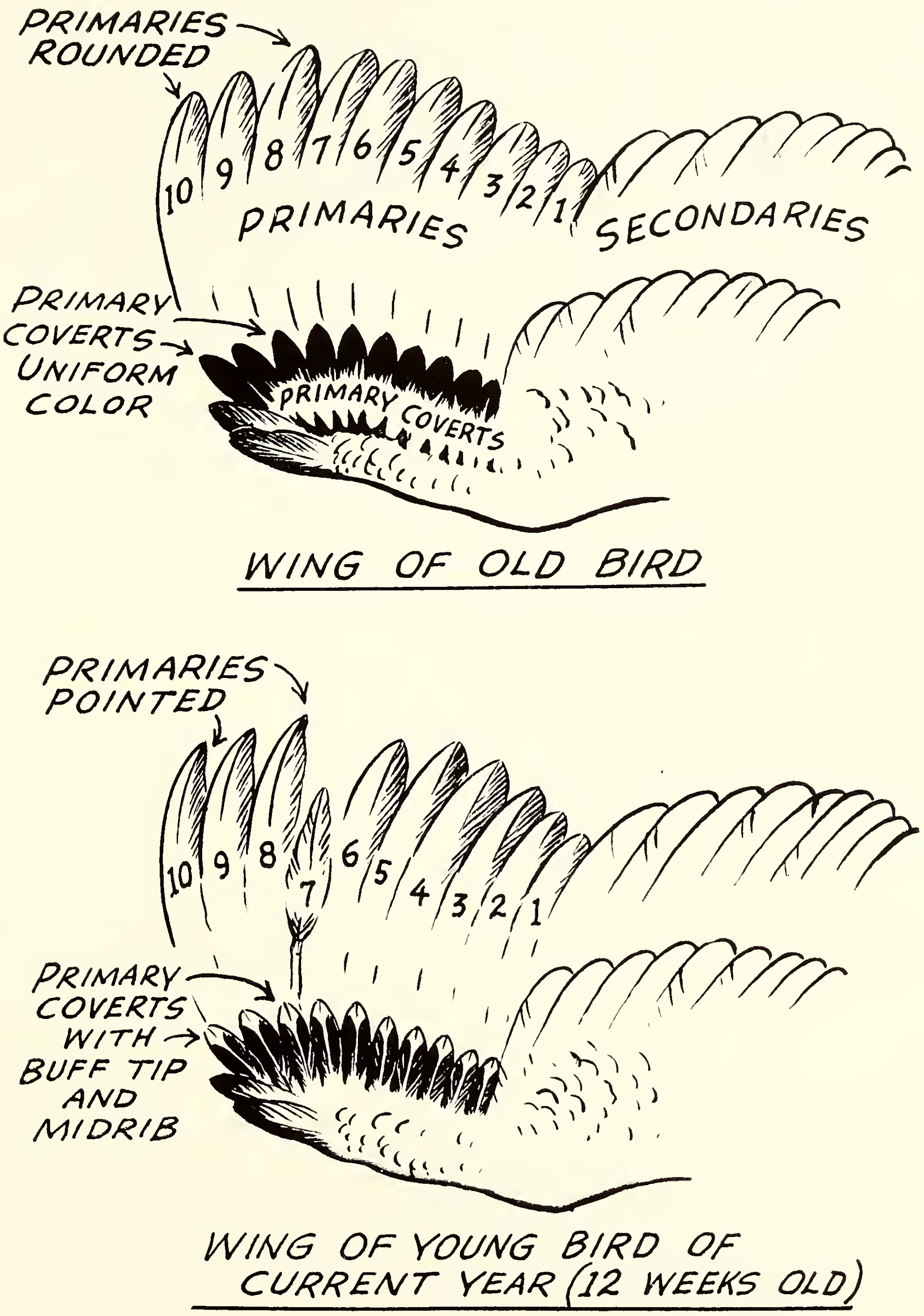
PRIMARIES ROUNDED
10
9
8
7
6
5
4
3
2
1
PRIMARIES
SECONDARIES
PRIMARY COVERTS UNIFORM COLOR
PRIMARY COVERTS
WING OF OLD BIRD
PRIMARIES POINTED
10
9
8
7
6
5
4
3
2
1
PRIMARY COVERTS WITH BUFF TIP AND MIDRIB
WING OF YOUNG BIRD OF CURRENT YEAR (12 WEEKS OLD)

Figure 8. The wing of the juvenile bird has light tipped coverts and pointed primaries, while the wing of the adult has more rounded primaries and uniform gray coverts.

weeks of age a Cooper's hawk had picked off another that was a little slow in reaching escape cover. At ten weeks of age one of the birds failed to make it across the highway ahead of a speeding automobile.

Figure 9. Good escape cover prevents heavy predation.

By the first of November most of the foods that comprised the summer diet become scarce. The protective ground cover that has offered so much security is dying and becoming thinner. The birds are forced to wander to find security and happier hunting grounds. During this wandering the bonds that united the family circle are broken. Many of the now mature birds join other vagabond birds. This continues until suitable habitat is found and large winter coveys organized. This movement is known as the "fall shuffle" and is very evident in Florida.

Sex and Age Ratios

By collecting sex and age data from wild birds we are able to learn much about natural productivity and population dynamics. Most of these data are obtained by examination of birds shot during the hunting season. Sexing the birds is easy because of the difference in markings. It is possible to determine whether the bird is an old bird or a young of the year by examining the primary wing coverts. If the midrib and tip of these feathers are buff or cream colored it is a young bird. If the feathers are a uniform blue-gray it is an old bird. This is illustrated in Figure 8.

Many sex and age studies have been conducted throughout the country. Without exception these studies indicate a preponderence of cocks in the bobwhite population. For example, in a sample of 20,000 birds from north Florida and south Georgia, Stoddard (1936) found 53.3 per cent cocks and 46.7 per cent hens. Examination of over 51,000 birds in Missouri by Bennitt (1951) revealed 53.0 per cent cocks and 47.0 per cent hens. Lay (1952) found 52.6 per cent cocks and 47.4 per cent hens in 4948 Texas birds. Murray examined 1,084 west Florida birds and Frye (1954) 17,049 south Florida birds. The west Florida population consisted of 51.6 per cent cocks and 48.4 per cent hens. In south Florida it was 51.7 per cent cocks and 48.3 per cent hens. These studies were broken down further to show the sex ratios in both the old and young birds. Bennitt found in the old bird population there was a ratio of 143.7 cocks per 100 hens; while in the young birds it was 101.9 cocks per 100 hens. Lay noted 131.3 old cocks per 100 hens, and 103.2 cocks per 100 hens among the young birds. Murray found 153.7 old cocks per 100 old hens, and 96.5 young cocks per 100 young hens in west Florida. Frye found 119.1 cocks per 100 hens in the old bird population in south Florida and 103.6 per 100 hens in the young bird population.

The much higher percentage of cocks among the old birds in all these studies illustrates the well known characteristic of the bobwhite — that natural mortality operates to the disadvantage of the females and thus normally produces an excess of cocks. Since the winter sex ratio of the young is near 50:50, the loss of females must occur after the covey breakup or during the breeding season. At this time the hens are heavy with eggs and engaged in nesting and are probably more vulnerable to predation than at any other time of the year. It is unlikely, however, that this loss of nesting hens affects the winter quail population to any appreciable extent. The cocks normally assume the responsibility of hatching the eggs or rearing the young when their mates are lost but, more important, the number of young reaching maturity is determined more by the adequacy of the habitat to rear young than the number of young hatched. At any rate, there are usually plenty of young reared to fully stock the fall coverts if the weather has been favorable.

Another interesting fact is revealed when the age ratio of the winter birds is examined, — that around 80 per cent of the population are young birds. Protection from hunting leads to but little reduction in this percentage of young birds in a population. Bennitt found 81.9 per cent young in his Missouri populations. Lay found 78.4 per cent among his Texas birds. Murray found 78.3 per cent young in the west Florida birds. Frye noted 77.7 per cent young in south Florida. This means that there is an approximate 80 per cent turnover in the population every year or that 80 per cent of the birds present in any winter will perish from some cause or another before the next.

To use a hypothetical example, suppose we consider our family of the now-remaining ten birds. Although they are now in mixed coveys, eight of them will die before the next winter. The eight that die will be replaced by eight more that are reared during the coming summer. This is what is known as population turnover. Fortunately it is high among quail. If it were not, it would take many years to build back a population that occasionally suffers from catastrophic conditions such as hurricanes in south Florida or years of extreme drought in north Florida. In such years in Florida local percentages of juveniles may drop as low as 52.4 per cent (Frye 1954). This means that each old pair reared only two young, and instead of the ten birds that are remaining in our normal hypothetical family, there are only four. This may also mean that the winter population has dropped 60 per cent from the winter before. Four coveys will be using the same range that ten used the winter before or the coveys will be greatly reduced in size. Thus we see how adverse weather conditions may greatly affect winter populations.

The subject of bird harvest is one of considerable controversy. There has been much discussion over the number of birds that can be safely removed by hunting to leave adequate breeding stock. Again suppose we look at the 80 per cent annual turnover in the population . . . eight out of ten birds will disappear before the next winter. They disappear whether or not *any* of them are killed through hunting. This is well illustrated by comparisons of percentages of juveniles from hunted and unhunted areas in Charlotte County. The 62,000

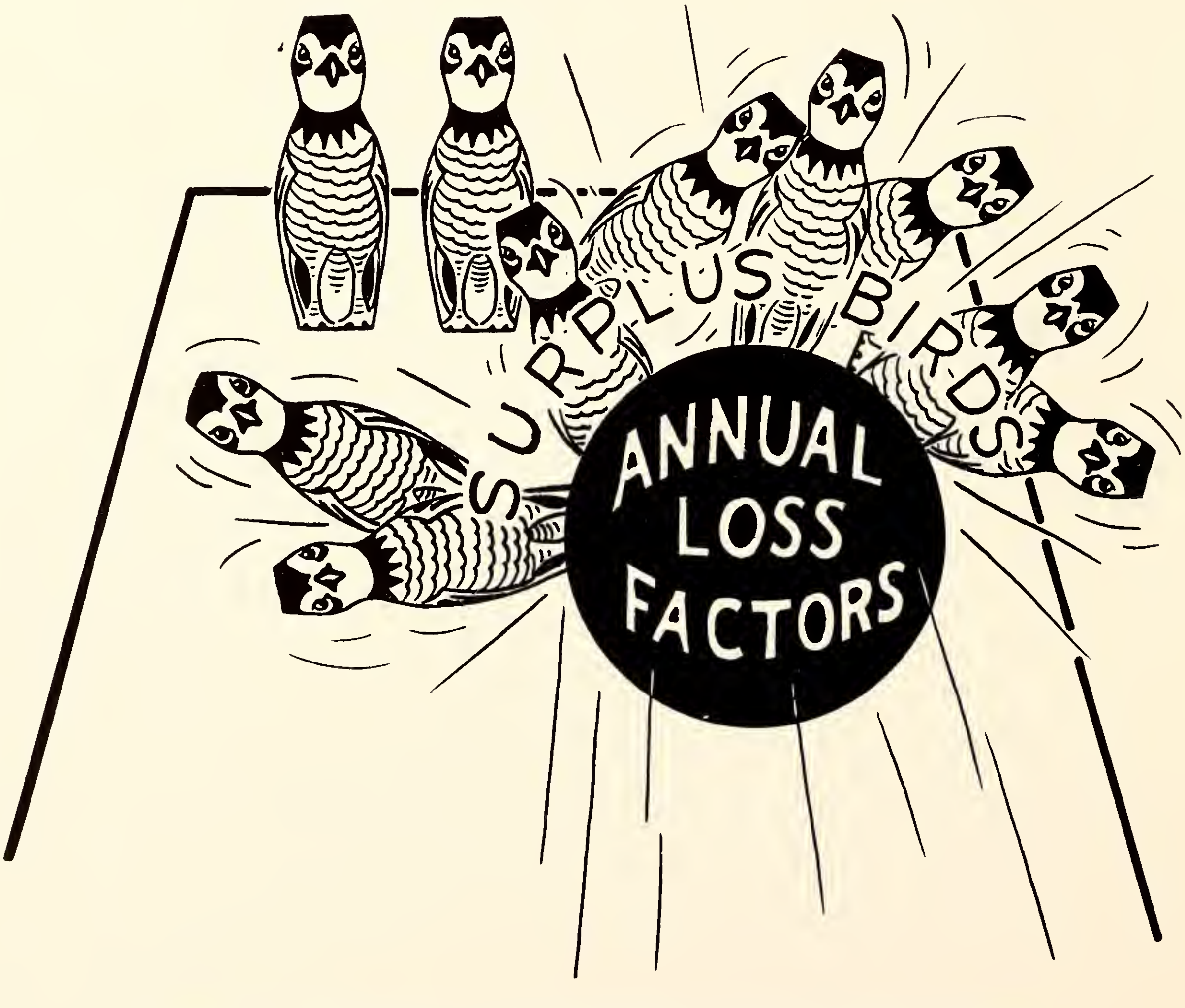

Figure 10. There is an annual population turnover of approximately 80 per cent whether or not the birds are hunted.

acre Cecil M. Webb Wildlife Management Area had not been hunted for seven years prior to 1950. In a sample of more than 2000 birds taken from the Management Area, the percentage of juveniles was 72.3 as compared to 78.4 for other territory in the county subject to heavy hunting pressure annually. It is only good use of a natural resource to utilize a large percentage of these birds that would be lost anyway. This theoretically could permit harvest of 80 per cent of the population if there were no losses other than to man. However, if we want to "spot" nature to take care of the occasional hen that will die during the summer, perhaps half of the birds should be left. If there has been a severe drought or hurricane to reduce the population below normal, the harvest will have to be smaller to leave the same number of breeding birds. However it should be noted that when the breeding population of birds is low, the rate of "comeback" is rapid. This is the principle of inversity which was described for gallinaceous birds by Errington (1945). Unusual decreases in total population one year are likely to be offset by unusual increased productivity the following year. In view of this, perhaps four or five birds per covey are more than enough to leave even though the population is down.

We have been assuming that we have complete control over the harvest and could remove a given number of birds from each covey. This, of course, is a purely artificial situation and does not exist in reality. In Florida many coveys are never shot by hunters, simply because they are never found. It is believed that not over 30 per cent of the wintering bird population in west Florida is lost through hunting, while up to perhaps 60 per cent may be taken in the more open areas of south Florida. This is far from the 70 to 80 per cent figure that will disappear before the next hunting season. In view of this it appears that our birds are being underharvested rather than overharvested.

Thus, the number of birds that should be left in each covey is really inconsequential. Many sportsmen believe that the leaving of a certain number of birds per covey is necessary to maintain adequate breeding stocks. This would be true if all coveys were shot. However, in most Florida quail territory there are sufficient birds in "swamp" and other inaccessible coveys to normally restock all covey ranges even though individual coveys are too heavily shot. Also of importance in preserving adequate breeding stock each year is the fact that, as the shootable portion of the quail population is reduced by heavy shooting and hunting becomes poor, the average hunter has less incentive to hunt and thus hunting pressure on the remaining birds automatically lessens. The birds themselves also assist in the matter by becoming more wary — sometimes remaining in heavy cover at all times, flushing wild, flying out of sight, running ahead of the dogs, and in other ways becoming more difficult to bag.

Some states attempt to control the bird harvest by placing additional restrictions on take if summer productivity is low. Seasons are shortened, or the bag is decreased. The whistling or call count has been acclaimed as a management tool in some states by which seasons can be set in advance. This is supposed to be indicative of productivity. It would be interesting if these states learned what per cent of their bird population is removed by guns and to what extent their productivity is increased by the placing of additional restrictions. The writers feel that, in Florida at least, rigid control of harvest is unnecessary and is poor quail management. Productivity can be increased in more effective ways.

Food Habits

Food habits studies are valuable from the standpoint that they enable investigators to learn what the principal foods are. With this knowledge in hand, the best methods of managing these foods can be prescribed. Food habits studies have been conducted in almost every state within the range of the bobwhite. One of the first was conducted in the north Florida-south Georgia area by Stoddard & Handley (1936) in the early 1920's. Most studies have been conducted during the winter for two reasons: (1) This is the time when most material is available since investigators can collect large numbers of crops from hunters. (2) It has always been felt that this is the time of year when food is the scarcest and therefore the time to gain knowledge of the leading foods and their management.

The bobwhite is primarily a seed eater. Many species of seed are utilized as food. The ten leading fall and winter foods for northwest, central, and south Florida, as determined by three Florida food habits studies, are presented in Table I.

These are the leading foods, considering the amounts of each utilized. Quail do not require a wide variety of foods. One or two staple foods high in mineral and vitamin content forming the major part of their diet will carry them through the winter in fine shape. Generally the foods that are utilized most in an area are those that are most available. Michael and Beckworth (1955) determined that quail do not have to learn to like a new food when it is introduced. Good foods are recognized and eaten when first encountered. It appears in Florida that the matter of availability or quantity of a food is of greater concern than quality or preference. On our ranges greater rewards are obtained from efforts directed at increasing the quantity or availability of a staple food rather than those directed at improving the quality of a food or attempting to introduce highly preferred foods that never become readily available.

Poisonous Foods

The subject of poisonous foods does not require much discussion since they are of little or no significance in quail management. The misconception still exists among some that toxic seeds of a few plants take a heavy toll of our bird population annually. Both Stoddard (1936) and Michael and Beckwith (1955) state that birds are able to distinguish toxic seeds from others and therefore do not utilize them as food. Occasionally one may consume a seed or two accidentally while picking up other seed. However it is believed that seldom, if ever,

Table I. Leading Foods of Florida Bobwhites

Murray
1,000 northwest Florida birds
(Collected during the period 1948 to 1953)

Acorns (*Quercus* spp.)
Peanuts (*Arachis hypogaea*)
Beggarweeds (*Meibomia* spp.)
Corn (*Zea mays*)
Common lespedeza (*Lespedeza striata*)
Partridge pea (*Chamaecrista* spp.)
Milk pea (*Galactia* spp.)
Flowering dogwood (*Cynoxylon floridanum*)
Watergrass (*Paspalum boscianum*)
Pine mast (*Pinus* spp.)

Laessle (1945)
135 central Florida birds
(Collected during the period 1938 to 1939)

Acorns (*Quercus* spp.)
Wax myrtle (*Cerothamnus* spp.)
Milk peas (*Galactia* spp.)
Summer Farewell (*Kuhnistera pinnata*)
Partridge pea (*Chamaecrista* spp.)
Gopher apple (*Geobalanus oblongifolius*)
Panicum (*Panicum* spp.)
Pine mast (*Pinus* spp.)
Dollar-leaf (*Rhynchosia* spp.)
Ragweed (*Ambrosia* spp.)

Frye (1954)
3,789 south Florida birds
(Collected during the period 1946 to 1953)

Wax myrtle (*Cerothamnus* spp.)
Slough grass (*Scleria setacea*)
Acorns (*Quercus* spp.)
Puffball fungus (*Rhizopogon* spp.)
Green vegetation
Pine mast (*Pinus* spp.)
Paspalum (*Paspalum* spp.)
Gallberry (*Ilex* glabra)
Love vine (*Cassytha filiformis*)
Cabbage Palm Fruits (*Sabal palmetto*)

is a lethal number consumed. Some of the seeds known to be toxic and common to much of Florida are:

Coffee weed *(Cassia tora)*
Coffee senna *(Cassia occidentalis)*
Crotalaria (esp. *Crotalaria spectabilis)*
False poinciana *(Daubentonia punicea)*
Bladderpod *(Glottidium vesicarium)*
Chinaberry *(Melia azedarach)*

Poisoning Due to Insecticides and Rodenticides

During recent years there has been a tremendous increase of chemical insecticides used in cotton and peanut farming in west Florida. Numerous complaints have been made that dusting with these insecticides has been the cause of heavy quail mortality. An experiment was conducted by Dahlen and Haugen (1954) at Auburn, Alabama, to determine at what concentration some of the newer insecticides would prove toxic to quail and doves. They state that it is very unlikely that birds could accumulate sufficient toxicants to cause death from field applications.

The widespread distribution of poisoned grain in rodent control is believed to be much more serious. There is considerable evidence to indicate significant losses of quail from this practice.

Predation

The matter of predation has in the past been given attention disproportionate to its importance. It is only within the last twenty years that the role of the predator, or predator-prey relationship, has been clearly understood in the game management field. There are still many false concepts among sportsmen and laymen regarding predation. We still hear that foxes, house cats, and hawks are killing all the quail. Probably contributing to this belief, particularly in northwest Florida, is the fact that predator control was once considered a very important phase of quail management on the large game plantations. The theory was that even one quail killed by a predator meant one less bird in the bag of the hunter who was footing the bill to grow them. Another reason is that until recently most game departments emphasized predator control as an important game management tool. Probably the principal reason is that man is inclined to place the blame (for low game populations) on anything other than himself or his own activities.

One method of evaluating the destruction of quail by any species of predator is a food habits study of that species. If it eats quail the evidence will be found in the digestive tract. The more digestive tracts that can be examined, the more reliable the study. Many such studies have been conducted throughout the country. Results of a few are presented here. These data are compiled from Latham (1950) and Korschgen (1952).

Table II. Occurrence of Quail in Food Habits Studies of Some Predatory Species

Species of Predator	No. Stomachs or Pellets Examined	No. Stomachs or Pellets Containing Quail	Per cent Occurrence
Cooper's hawk	449	24	5.3
Sharp-shinned hawk	371	0	0
Red-tailed hawk	568	6	1.0
Red-shouldered hawk	231	1	.4
Marsh hawk	445	5	1.1
Great horned owl	3,354	14	.4
Bobcat	281	2	.7
Gray fox	596	4	.7
House cat	174	1	.6

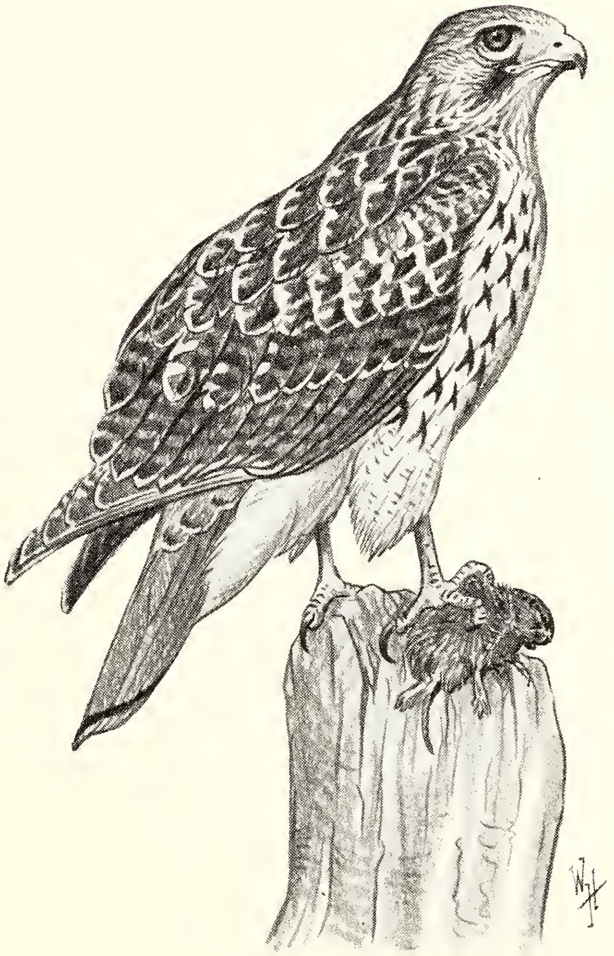

Figure 11. The red-tailed hawk eats large quantities of cottonrats, one of the worst enemies of quail nests.

We see from these figures that none of the predators take enough quail to seriously damage the population. The studies showed that the main diet of most of them consists of mice, rats and rabbits. The good that they do in killing these pests surely offsets the harm done to the quail population. The cotton rat is a staple food of most predators in the South. This animal is one of the worst enemies of quail nests. The only common predators that feed upon bird life to a greater extent than mammal life are the blue darters, the Cooper's and the sharp-shinned hawks. Non-game birds make up most of the diet of these two.

Among the quail that are taken by predators it is never known how many of them were picked up as carrion. Undoubtedly many of them are birds that have died or are suffering from other causes. At any rate the birds that are taken are among the eight out of ten that will disappear every year from some cause, because they are birds over and above the carrying capacity of the land. The greater the surplus or excess above the carrying capacity of the land, the greater will be the number taken by predators.

Thus it may be said that predation is a natural and normal phenomenon. It is one of the factors contributing to the natural mortality of the weak and unfit birds. Through it the strongest and fittest are selected to keep the race strong and healthy.

Predator control is costly and ineffective. The authors feel that it is impractical, unnecessary, and can offer no appreciable contribution to quail management in Florida. Time and money spent on predator control are more wisely spent on habitat improvement.

RESTOCKING

Restocking with quail has at some time played an important role in the policies of almost every state game department. It has always been a colorful and popular public relations program requested by sportsmen and demanded by political groups. Today it is largely abandoned as a sound quail management tool, although there is still considerable demand for "turning birds loose." After years of attempting to restore bird populations in this manner most states discovered it to be a costly means of producing only negative results. Birds used for restocking purposes have come from several sources, foremost of which has been state game farms producing pen-reared birds. Mexico was another source until an embargo was placed on quail, prohibiting their importation into this country. Wild trapped birds have been widely used in Florida but the actual contribution toward increasing quail populations of even this excellent stock is questionable under normal circumstances.

Restocking with pen-reared birds has proven to be a costly and almost negative way of putting a bird in front of the sportsman's gun. Evidence of this has been gained from studies conducted by many states. The study methods consisted primarily of banding the birds released and obtaining returns of the bands from hunters during the hunting season. This gave some indication of survival after release. Results of some of the studies were compiled by Buechner (1950) and are presented below in tabular form.

Table III. Summary of Returns from Banded Pen-reared Birds

State	No. Birds Released	No. Bands Returned	Per cent Returns of Birds Banded
Oklahoma	140,062	1,668	1.19
Pennsylvania	12,420	76	.61
Indiana	6,098	183	3.0
Missouri	366	3	.82
Total	158,946	1,930	1.21

We can see from these figures that the survival of pen-reared birds after release is very low. They are unable to adjust themselves to a wild existence. Pierce (1948) found in Kentucky that 72 per cent of his birds released disappeared from his study area within two months after release, and that 92 per cent disappeared within five months.

The economics involved are quite startling. States report costs of from $0.68 to $3.00 per bird released. Suppose it costs a state $0.70 per bird to rear and release them. If only 1.21 per cent of them are killed by hunters, the cost of every released bird shot jumps to $57.85. Perhaps this figure could be reduced somewhat if consideration is also taken of the invariably few offspring of the released quail. Even with the most generous allowances for such offspring and non-return of bands, this remains costly shooting, and since the sportsman is paying the bill, it is an unfair and unjust expenditure of his money.

The more we learn regarding quail populations, the more we realize that most restocking is unnecessary and unjustified. Almost without exception, if a range is carrying a low number of quail it is deficient in food or cover. It has a low carrying capacity. This means that it will support only the existing low number of birds regardless of the number that might be added, assuming that nothing is done to increase the carrying capacity. If the range is improved by the addition of food and cover, the bird population will increase through natural production. Seldom in Florida is a quail range understocked. Even when subjected to catastrophic weather conditions, the population builds back to the carrying capacity rapidly. In the majority of cases when birds are released, even if they are native wild trapped birds, the range is then overstocked. A surplus results, and according to the laws of population dynamics, this surplus is going to be rapidly removed through predation and natural mortality until the population is in balance with the carrying capacity. So, nothing is accomplished in the end.

In certain areas of the state annual restocking with wild trapped birds has been the practice for years. Where such birds can be obtained at relatively little cost and are released in areas open to the public and subject to extremely heavy hunting pressure such releases may serve as insurance and are of some public relations value. Such restocking has the possibility of being worthwhile and is most applicable principally in the open flatwoods areas of south Florida where a much heavier kill is possible than in those areas with brushy thickets or dense woods and where the drive method of quail trapping can be employed effectively.

We often find that the man who is most vociferous in his demands for restocking is the man who has ruined the carrying capacity of his land for quail and awakens to the fact that his birds are gone. Perhaps he put his land in beautiful improved pastures and removed the last bit of natural food and cover. To place birds in such surroundings and expect them to remain is pure folly. No cattleman can expect to produce more pounds of beef on a fully stocked range by adding more cows unless he first increases the carrying capacity of that range. Quail populations function the same way.

The authors feel that restocking is largely if not entirely unnecessary in Florida. It is a very impractical and ineffective means of attempting to increase quail populations.

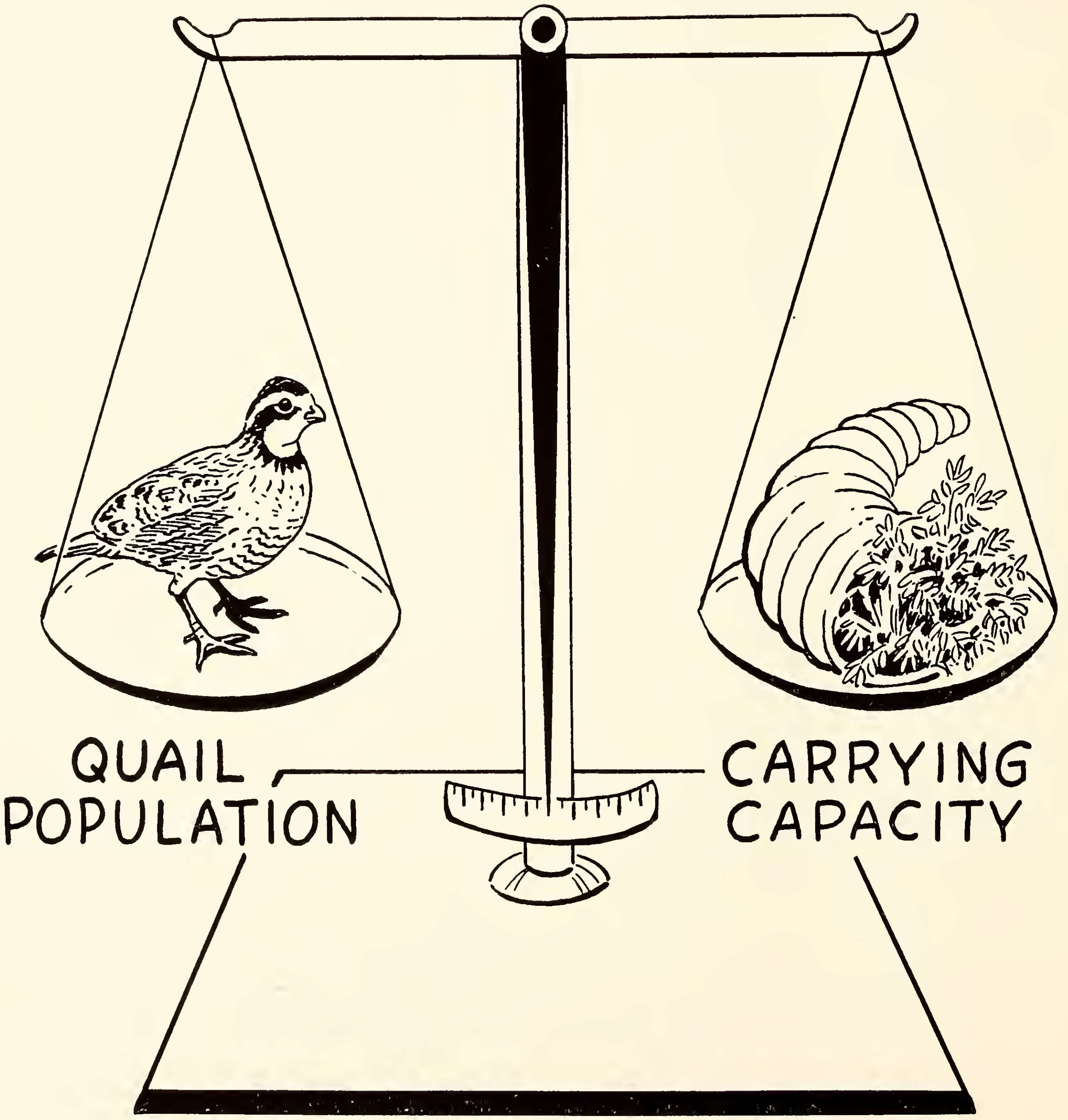

Figure 12. The quail population will depend upon the carrying capacity of the land.

MANAGEMENT

We do not have the quail that we once had in the State principally because of changing patterns of land use. The landscape has changed so radically in places that extensive tracts of land have become completely unproductive of quail. Examples are the vast acreages of land that have been cleared for the establishment of improved pastures and citrus groves in some sections of the State. In these extremes, destruction of natural food and cover is virtually complete. Although there has been a trend from the row or cash crop type of agriculture to cattle production in the northern section of the State in recent years, the change has not been so pronounced as in other sections of the State. In south Florida pasture improvement involving the destruction of palmetto and other cover over large acreages is an extremely serious problem insofar as quail production is concerned.

For high quail production there must be good interspersion of food and cover over as much of the land as possible. By food is meant plant seeds utilized as food whether they are cultivated crop plants or native wild plants. By cover is meant vegetative growth where birds take refuge to escape their enemies, whether it is a swamp or thorny hedge row of north Florida or a palmetto clump on the flat woods land of south Florida. Up to a point, the more the landscape is divided or broken up into food producing areas in close proximity to areas of good cover, the higher will be the quail population. In pioneer times small parcels of land were cleared and cropped which made for a good distribution of food and cover and hence abundant quail. Where such "patch" farming practices exist today quail are still abundant. Of course there is a maximum limit to quail production. Over any sizable area, 5,000 acres or more, the maximum population attainable is considered to be a bird per acre, regardless of the degree of development. This population is seldom attained except under the most intensive management as typified by the large quail plantations of north Florida. Here, where as nearly as possible every inch of the land is producing food or cover for birds, the winter population drops to a bird per two or three acres. The winter population over the State as a whole is probably somewhere around a bird per fifteen or twenty acres.

We can no longer consider quail production as an incidental crop, or in other words, something that will be or will not be. With the present advances of land use and the increased demand for hunting we cannot afford to take this casual attitude. If we are to have quail we must employ means to produce them. Quail production has to be treated the same as the production of any other crop. There will have to be an expenditure of time and capital. The day of "free" quail and "free" quail shooting is practically a thing of the past. The sooner sportsmen realize this, the better. No one is more aware of the cost of producing quail than the preserve owner who sits down and writes up a $50,000 annual budget to produce them. Of course not many landowners can spend that kind of money for quail management. What we wish to show here is how quail management can be employed economically, practically, and effectively by any landowner or sportsman who is willing to expend a little effort to have quail shooting.

VEGETATION AND QUAIL

In order to gain some knowledge of quail food production it is necessary to know a little about plant ecology and what soil and climatic conditions produce certain plants. Plant ecology concerns the relationship of plants to their environment. Plant succession refers to the changes in vegetation that accompany changes in plant environment. These changes are influenced by the vegetation itself, land management, disturbance and other factors.

The major quail habitat types in Florida are rolling sand or clay pinelands and flat pinelands. Both of these types are broken up by hardwood hammocks, swamps, marshes and lakes, whose borders form an important part of the overall quail habitat. In the natural state, dominant plants in the rolling pinelands are wire grass, long leaf pine, loblolly pine, and various species of oaks — particularly live oak, turkey oak, and runner oak; in the flat pinelands — wire grass, gallberry, saw palmetto, slash pine, southern slash pine, longleaf pine, and runner oak.

In both types of pinelands, following disturbance or plowing of the soil, succession proceeds from the annual weed and grass stage to the perennial weed and grass stage and eventually back to the original vegetation. In the following listings the symbol (1) indicates plants of high value as quail food; the symbol (2) indicates quail food plants of less importance; the remaining plants are of no quail food value. Species that characterize the first or annual weed and grass stage on one or both types of pinelands the first year the land is plowed are:

(1) Crabgrass *(Syntherisma digitatum* and *S. floridanum)*
(2) Switchgrass *(Panicum dichotomiflorum)*
(1) Watergrass *(Paspalum boscianum)*
Sandbur *(Cenchrus echinatus)*
Bermuda grass *(Capriola dactylon)*
(1) Nut grass *(Cyperus compressus)*
(1) Cranesbill *(Geranium carolinianum)*
(2) Pusley *(Richardia scabra)*
(2) Buttonweed *(Diodella teres)*
(1) Florida beggarweed *(Meibomia purpurea)*
Coffeeweed *(Cassia tora)*
(1) Ragweed *(Ambrosia elatior)*
Morning-glory *(Thyella tamniflora)*
(1) Partridge pea *(Chamaecrista* spp.)
(1) Slough grass *(Scleria setacea)*
Long seeded grass *(Rhaphis pauciflora)*

Vegetation during the second and third year is characterized by the following species:

Bermuda grass *(Capriola dactylon)*
Beard grass *(Gymnopogon ambiguus)*
(2) Witchgrass *(Panicum capillare)*
(1) Paspalum *(Paspalum ciliatifolium* and *P. longepedunculatum)*
(2) Carpet grass *(Axanopus compressus)*
(2) Buttonweed *(Diodella teres)*
Dog-fennel *(Euphatorium capillifolium)*
Sneezeweed *(Helenium tenuifolium)*
Goldenrod *(Solidago* spp.)
Aster *(Aster* spp.)
(1) Partridge pea *(Chamaecrista* spp.)
(1) Milkpea *(Galactia* spp.)
(2) Blackberry *(Rubus* spp.)
(2) Beak rushes *(Rynchospora* spp.)
Hatpin *(Eriocaulon* spp.)
Yellow-eyed grasses *(Xyris* spp. esp. *X. serotina)*

The perennial weed and grass stage that comes in next is characterized by the following species:

Broomsedge *(Andropogon virginicus)*
(2) Witchgrass *(Panicum capillare)*
(2) Winter rosette panic grass *(Panicum* spp.)
Aster *(Aster* spp.)
Goldenrod *(Solidago* spp.)
Sunflower *(Helianthus* spp.)
(2) Blackberry *(Rubus* spp.)
Persimmon *(Diosporos virginiana)*
(1) Sassafras *(Sassafras varifolium)*
(2) Carpet grass *(Axanopus compressus)*
(1) Paspalum *(Paspalum ciliatifolium* and *P. longepedunculatum)*
Hatpin *(Eriocaulon* spp.)
Yellow-eyed grasses *(Xyris* spp.)
Pennyroyal *(Picnothymus rigidus)*
Blue Maiden cane *(Amphicarpon floridanum)*
Love grass *(Eragrostis bahiensis)*

Obviously, this latter stage of plant succession is of least value to quail since there are very few plants producing quail food. A broomsedge field provides good cover, but is virtually a desert as far as food is concerned.

HABITAT IMPROVEMENT

Quail food production can be accomplished in Florida by three principal techniques — manipulation of native vegetation, planting of food plots, and use of artificial feeders. Each of these techniques has a particular application to the three major types of land use — farming, timber production, and ranching — that prevail on lands practical for quail management.

Encouraging Native Food Plants

One of the simplest and most effective ways of increasing quail food consists of managing agricultural or forest lands in such a manner that native food plants are encouraged. A frequent situation where this may be accomplished occurs when dense stands of trees are thinned through selective cutting or other means. In this case, perennials such as wiregrass and palmettoes on virgin soil, or broom sedge on previously cultivated land, soon become dominant. These plants must be controlled to permit valuable food plants to grow. This can be accomplished by either controlled burning, discing, or chopping. Where game is of secondary importance it may be more advantageous to use a disc or chopper than fire, especially where there are young pines that may be destroyed by fire. Otherwise fire is a much cheaper and quicker tool.

Fire is a management tool that must be used carefully and properly or results can be more destructive than beneficial. Burning normally should be done only in the fall or winter. Wind and moisture conditions must be such as to avoid a hot wild fire that may get out of control. Where forestry is the principal land use, a forestry technician should always be consulted before burning.

Discing or chopping in woodlands or old fields is also helpful in encouraging annual plants of value for quail food. With discing as with fire, the aim is to suppress perennial vegetation to the advantage of annuals.

Following are some of the most valuable of the many quail food plants that result from reduction of perennial vegetation through discing, chopping, or burning:

Partridge pea *(Chamaecrista spp.)*
Beggarweed *(Meibomia spp.)*
Milk pea *(Galactia spp.)*
Butterfly pea *(Bradburya virginiana)*
Wild sweet pea *(Cracca spp.)*
Wild bean *(Strophostyles umbellata)*
Bush clover *(Lespedeza spp.)*
Summer farewell *(Kuhnistera pinnata)*
Dollar-leaf *(Rynchosia spp.)*
Queen's delight *(Tragia urens)*
Queen's root *(Stillingia sylvatica)*
Croton *(Croton spp.)*
Panic grass *(Panicum spp.)*
Paspalum grass *(Paspalum spp.)*
Slough grass *(Scleria setacea)*

There are certain species of mast producing trees that are extremely valuable from the standpoint of the quail food they produce. Some of these are live oak, water oak, sweet gum, wild cherry, and flowering dogwood. In lumbering and clearing operations and in timber stand improvement work it is recommended that the following minimum specifications be met.

A. *For Longleaf, Slash and Other Pine Types*

1. No timber stand improvement should be done in areas containing less than ten oaks per acre.
2. In areas containing more than ten oaks per acre, a minimum of five well formed game food producing trees (oaks preferred) should be left in each acre. If possible, trees should be well distributed over the area. Trees with ten inch DBH or greater should be selected when available.

B. *Miscellaneous Hardwood Types*

1. A minimum of five well formed game food producing trees (oaks preferred) should be left in each acre. If possible, trees should be well distributed over the area. Trees with ten inch DBH or greater should be selected when available.
2. No stand improvement work should be done in live oak hammocks containing less than two acres.

Methods of cultivating row crops can frequently be modified to the advantage of native weeds and other vegetation of value to quail. For example, when corn is laid by early, there is normally sufficient time for a volunteer stand of Florida beggarweed or ragweed to make good growth and produce a good crop of first rate quail food. Any practical steps (such as laying crops by as early as possible and keeping cattle out of fields until after the plants have matured seed) that the farmer can take to encourage the legume, Florida beggarweed, will not only help quail but will also improve his soil.

Food Plots

One of the most practical and economical means of providing a dependable supply of quail food in farming areas is the planting of food plots. This technique is not so valuable in south Florida flatwoods. Plots can be located in odd areas that are unprofitable to cultivate and need not be over one-eighth acre in size. For example, the strip of land along the edge of the field adjacent to timber or a hedge row is perfect for food plantings and is at the same time unprofitable to cultivate. Sapping and shading of the soil by the trees in this area prevent successful growth of crops. Plants used for quail food production, however, do well in this location. It is wise land use and progressive farming to utilize this land and make it produce a crop of wildlife.

A one-eighth acre food plot is large enough to hold a covey of birds through the winter, providing there is a high seed yield. Where the landowner is attempting to raise quail intensively on such small parcels of land, it is essential that there be a staple supply of food in the plot. A yield of anything under 25 pounds of seed per plot, or 200 pounds per acre, is probably insufficient. High yields are obtainable only through proper planting, fertilization, and maintenance. For intensive quail management on farmland, a 40 acre field need have no more than one-fourth acre of food plantings. This is less than one per cent of the land, and certainly would not represent an appreciable financial loss to the farmer, especially when land is used that is unprofitable for the production of anything else. It is better, however, to have two one-eighth acre plots distributed about the forty acres than one one-fourth acre plot. More coveys of birds can be fed. The only essential requirement is that the plots be near or adjacent to cover. If the cover is so dense that it cannot be hunted, it is best to have the plot a short distance away. Otherwise the birds will run into it as the dogs approach and will be unavailable to the guns. An eight-acre strip or border along the edge of the field should be about 15 feet wide and 400 feet long. All plots need not be in the form of strips or borders, however.

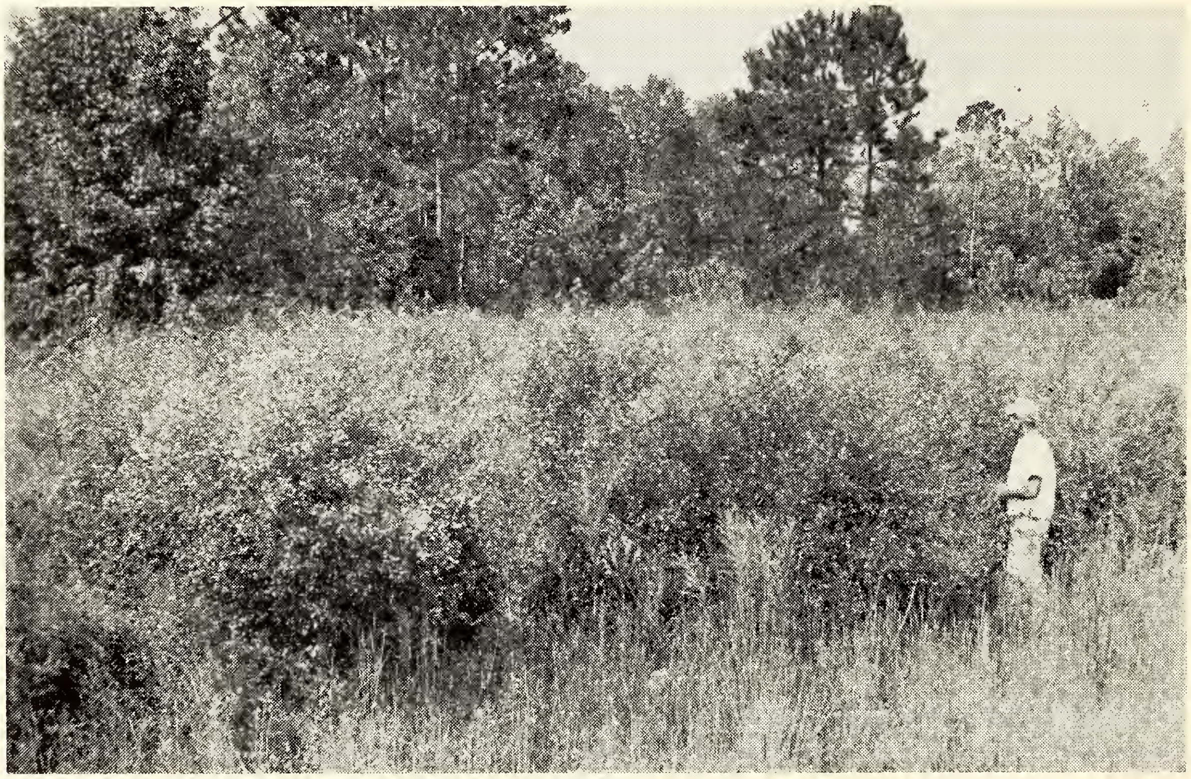

Figure 13. A thunbergii lespedeza field border.

Corners of fields or other odd areas difficult to cultivate are suitable. One important requirement for any food planting is that it be fenced against grazing livestock. In a field where fencing is necessary it is more economical to have the plot in a corner where fencing can be eliminated on two of the sides. If this is impossible, the cheapest kind of a plot to fence is one that is square in dimension. Three strands of barbed wire will usually suffice to turn cows and horses.

Seed and plants for the establishment of food plantings are distributed free of cost to interested landowners by the Game and Fresh Water Fish Commission each winter. This material consists principally of thunbergii lespedeza plants, partridge pea seed, and common lespedeza seed. These plants all produce hard seed, or seed that will last well on the ground throughout the winter. In addition, experiments are being conducted with other seeds that may be useful. Instructions on proper planting, fertilization, and maintenance of the principal food plants in use are presented below.

Thunbergii lespedeza: This is a tall, bush type perennial lespedeza averaging around six or seven feet in height. It has the advantage over other foods of being a perennial and thereby having to be planted only once. The twigs die back in the winter and the foliage drops, but the roots and old stems send forth new shoots again in the spring. Although it is the simplest type of planting to have and maintain once it is established, it is sometimes rather difficult to establish, especially during summer droughts.

A conventional size field strip or border is five rows wide and 400 feet long with the rows three feet apart. The plants are spaced at two foot intervals in the row. It takes approximately 1,000 plants to plant a one-eighth acre plot. Preparatory to planting, a good seed bed should be prepared by plowing and discing. The best time to plant is in February immediately upon arrival of the plants. Planting may be done by hand or more effectively by furrowing or using a mechanical tree planter. A tree planting dibble is the most satisfactory hand method. In furrowing, a furrow is opened for each row with a one-horse turning or breaking plow. The plants are stood against the side of the furrow at two-foot intervals and dirt thrown back to them with the plow. This method is satisfactory providing care is exercised in covering each plant to the proper depth — slightly above the root collar, which marks the depth the plant was in the ground before. None of the root should be left exposed. Planting is accomplished most rapidly with a mechanical tree planter. Care must be exercised in getting the plants properly spaced and the roots sufficiently covered. Whatever method of planting is employed, fertilizer should be applied in the row before planting at the rate of 800 pounds per acre or 100 pounds per one-eighth acre plot. Some mechanical tree planters are equipped with a fertilizer hopper so that fertilizing and planting can be done simultaneously in one operation. A 4-12-12 commercial fertilizer is recommended. The plants should be cultivated the first summer where there is weed and grass competition. Cultivation is unnecessary in successive years as the plants gain dominance and prevent the growth of weeds.

Maintenance consists of refertilizing the planting and discing, chopping, or mowing it every other year. This cuts the old woody stems and permits new growth to stool out at the ground and is important in keeping the plantings dense and vigorous. It should be done just before new growth begins in the early spring.

Thunbergii is suitable for food plantings in north Florida only on soil types with a clay subsoil. It cannot be grown successfully in central and south Florida because of the sandy structure of the soil. The leaching of plant nutrients and moisture on deep sands prevents successful establishment of the plant.

Partridge pea: This plant is an annual, but well suited to food plantings in Florida. There are two species used for seed distribution. One is the giant partridge pea *(Chamaecrista fasciculata)*, which is indigenous to north Florida. It grows to a height of six feet if fertilized. The other is *Chamaecrista brachiata*, a species which occurs in central Florida and does not attain a height of over three feet. The former is used for plantings in north Florida and the latter on well-drained soils in central and south Florida.

Partridge peas have several advantages over bush lespedezas for plantings in Florida. One is that the planting operation requires but little time and effort. Another is that they will thrive on much more infertile and sandy soils.

Planting is accomplished by the preparation of a good seed bed that has been fertilized with 2-12-12 fertilizer at the rate of 500 pounds per acre. On this bed the seed are sown broadcast at the rate of 16 pounds per acre. If the soil

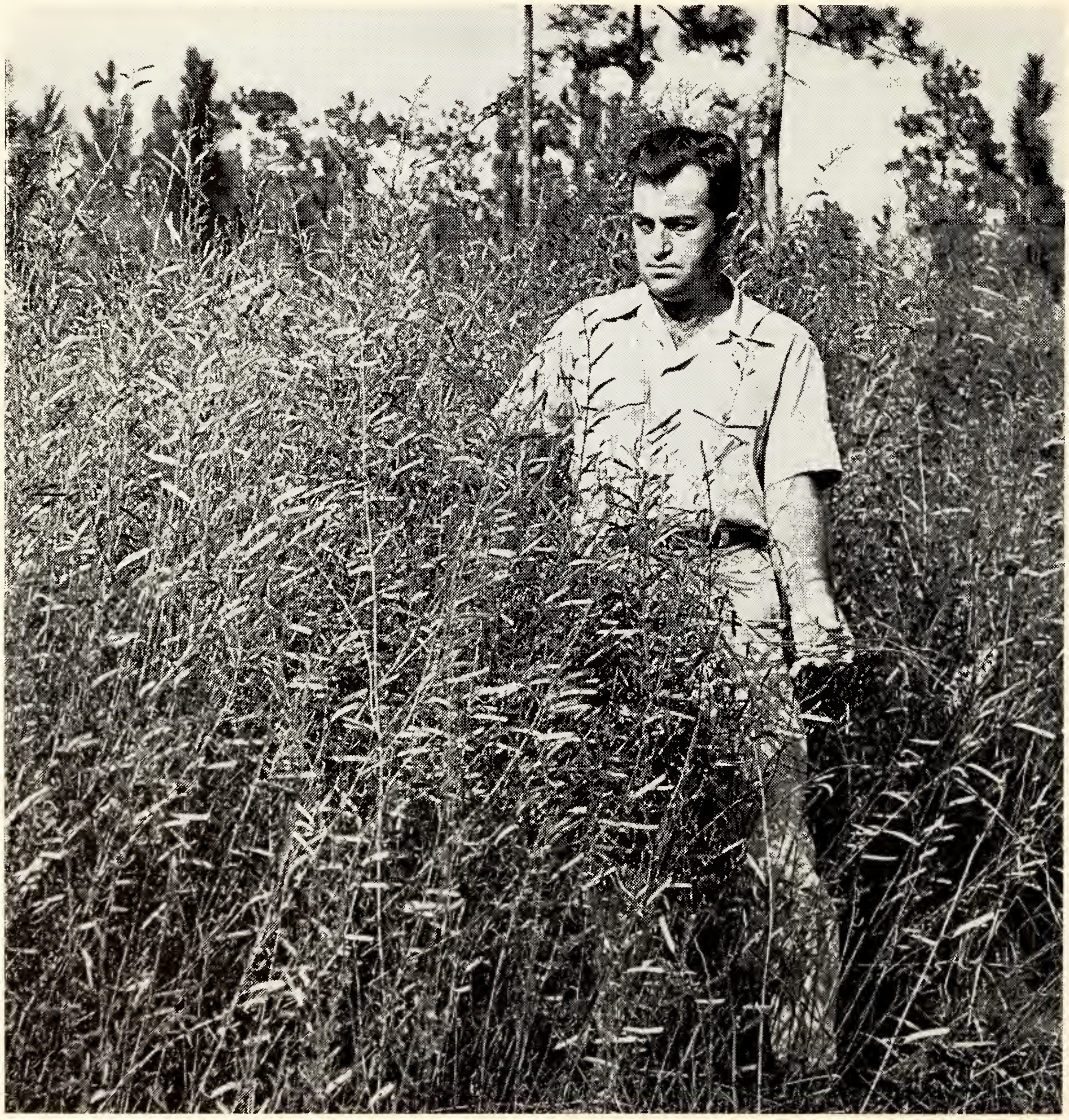

Figure 14. A planting of giant partridge pea *(Chamaecrista fasciculata)*. This species is well suited for plantings in north Florida.

is loose and fresh it is not necessary that the seed be covered as the first ensuing rain will do the job adequately. Otherwise, they should be covered lightly.

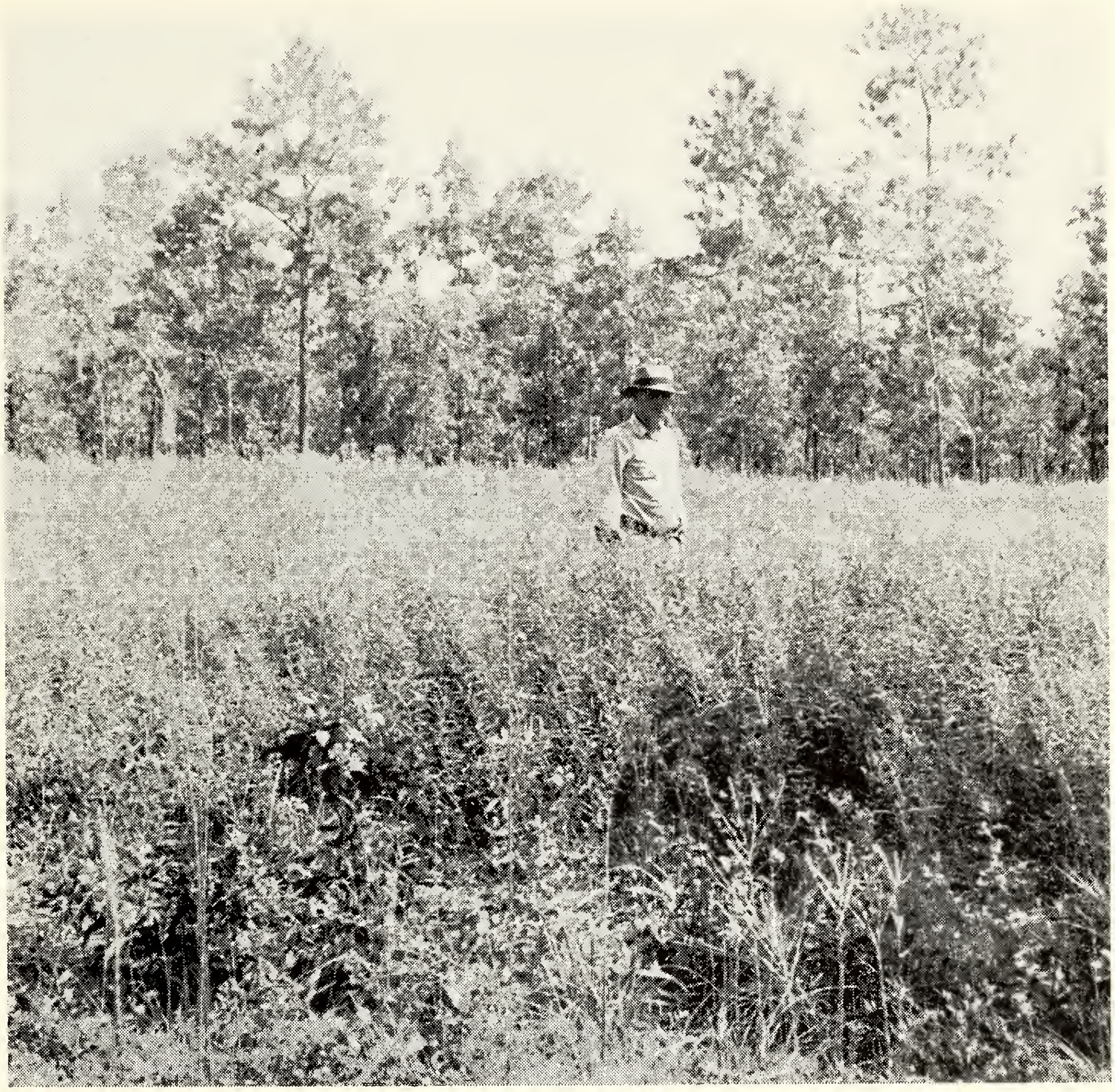

Figure 15. A planting of partridge pea *(Chamaecrista brachiata).* This species is well suited for plantings on well drained soil in central and south Florida.

Although the plant is an annual it usually reseeds to some extent the second year. However, this reseeding may not be sufficient for the maintenance of a good plot from year to year, especially if on dry or sandy soil. Burning the plot in late winter to scarify the seed, followed by light discing to cover it, will help toward insuring good seed germination. However, this requires as much time and effort as replanting the plot, so it is better to replant every year and be assured of a good stand of peas.

Common lespedeza: Common lespedeza is a low growing annual lespedeza that is usually less than six inches in height. It is an excellent quail food and thrives well in northwest Florida. Although it is usually sown in conjunction with grasses in pasture improvement programs, it can be found growing wild on many sites. It reseeds well, but after two or three years native weeds and grass gain control and a good planting becomes a poor planting. It is desirable to reseed plantings about every third year to assure good dense stands.

Methods of seeding are the same as with partridge peas. Twenty pounds of seed are broadcast per acre. Fertilization is at the rate of 800 pounds of 4-12-12 fertilizer per acre.

Sections of the State to which these three types of food are adapted are shown in Figure 16.

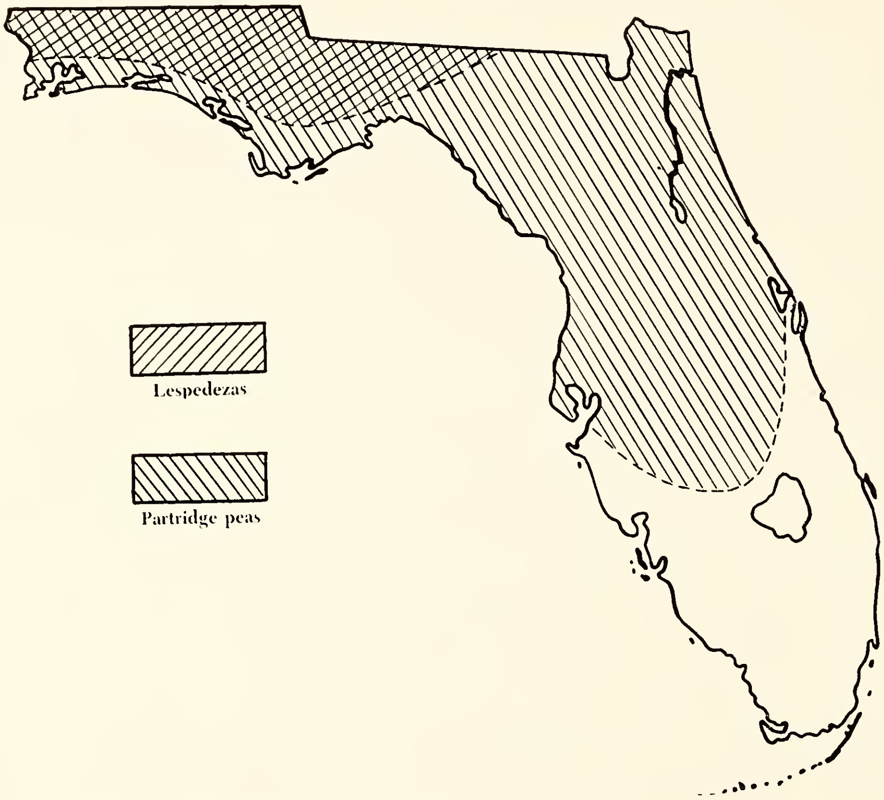

Figure 16. Practical growth range of food plant species currently being used.

Applications for planting material may be made to the Game and Fresh Water Fish Commission or to the local county Soil Conservation Service office. Most distributions are made through the cooperation of the Soil Conservation Service. The Commission and the various Soil Conservation Districts have joint agreements whereby both agencies work cooperatively in the development of land for quail.

There are other good foods, particularly various annual millets and legumes, that are not distributed by the Commission. The seed of most of these can be obtained through almost any seed store. Hegari and field peas are excellent fall foods that will grow successfully throughout the State. However, the seed deteriorate too rapidly to be good winter foods. Sesbania is a reseeding annual that is well suited for plantings on the poorly drained soils of south Florida. Florida beggarweed is an excellent food that does well throughout the state on fertile, well drained soil. One of the obstacles to its widespread use in food plots is the difficulty of obtaining seed for planting.

Use of Automatic Feeders

The automatic quail feeder is a legitimate quail management tool with definite but limited capabilities. It is of value only where food is the limiting factor. Where properly used under conditions of good cover and inadequate food, feeders have caused substantial increases in quail populations. At present they appear to be of greatest value on areas subject to heavy grazing and, because of cost considerations, their use has as yet been limited largely to private quail lands. Nevertheless, it is believed that the cost of birds produced by feeders compares favorably with the cost of birds produced by other intensive quail management tools such as food planting.

The feeder has two principal advantages over food planting on cattle lands: the elimination of fencing, and the feeders' year-round dependability as compared to the uncertainty of a good seed crop being produced in plantings. This is particularly true for the southern part of the state. At present we know of no quail food plants entirely satisfactory for planting under weather, soil, and drainage conditions typical of south Florida flatwoods. Also to be considered is the difficulty of planting so that seed is available at the time of year it is needed.

The disadvantages of feeders lie principally in their high cost, the necessity of constant maintenance, and the loss of feed to other birds and mammals. As experience is gained with their use, it will be possible to appreciably reduce the cost of feeder operation by discontinuing their servicing during periods of natural food abundance. For example, it will probably not be necessary to keep food in feeders during the months of October through December in years of normal abundance of natural foods. Loss of food to mammals can be greatly reduced by fairly simple rat and raccoon control programs. Losses to mourning doves can be charged off to the improvement of the lot of another excellent game bird. Losses to other birds in most cases must simply be tolerated.

Feeders can be used to supplement any of the previously mentioned management techniques such as prescribed burning and food planting. The one basic essential for successful use of feeders is the maintenance of ample ground cover and properly distributed refuge cover. Where such cover is present a reasonably heavy quail population can be supported by the foods produced incidental to any of the common land use practices. The addition of feeders to such situations can be expected to increase the quail population to the limitation imposed principally by the quality and distribution of cover. Any increase in quail resulting from the addition of feeders to an area will be inversely proportional to the degree to which natural foods already approach this limitation imposed by cover.

The number of feeders to be used on a given area is determined largely by the nature of the area. As a rule, a good starting point is one feeder per forty acres. This can be modified as conditions seem to warrant. Usually it is preferable on large acreages to put out a good concentration of feeders on a selected area in the center of the proposed quail management tract rather than to scatter them over the entire tract. The initial area can then be expanded as experience dictates. This will enable evaluation of the feeder area by comparison with similar lands without feeders.

Types of Feeders

Three principal types of feeders are in common use. One of these is simply a six- or seven-gallon galvanized garbage can with slits cut near the bottom to enable birds to get at the grain in the can and with a metal apron attached to the top of the can and extending outward to shelter the grain exposed by the slits. Another feeder, basically a modification of the garbage-can type, is being manufactured commercially by Scruggs Quail Feeders, Tampa, Florida. It differs from the garbage-can type principally in that it is suspended from a pipe driven into the ground. The third type consists of a four foot square framework of two-by-four lumber covered with a peaked galvanized metal roof with its apex approximately two feet from the ground. A metal food container properly slitted and of approximately five gallon capacity is placed under this shelter.

After experimenting with several types of openings for quail to reach the food in the containers, it has been found that the most practical arrangement is a simple horizontal slit two inches above the ground, three or four inches long, with the metal pushed in above the slit enough to permit quail to get at the grain but not enough to allow the grain to spill out upon the ground.

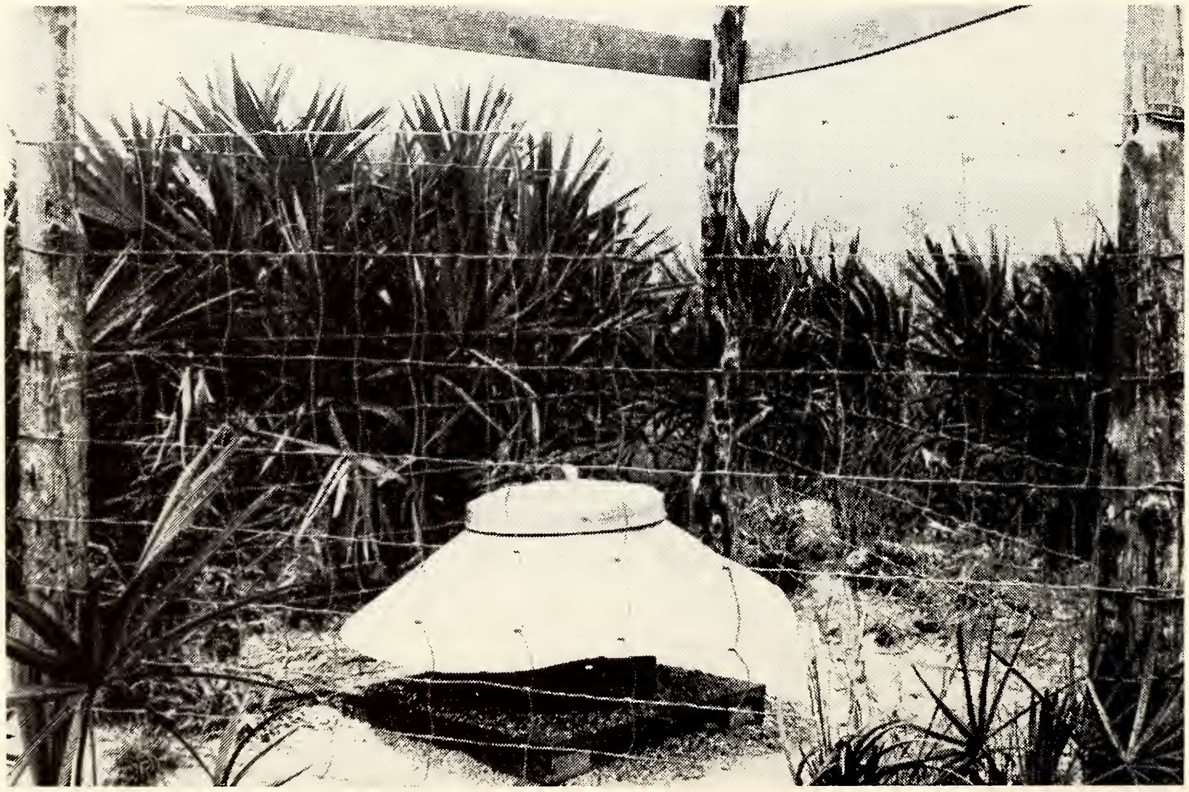

Figure 17. The artificial feeder is an excellent tool under certain conditions.

Where hogs and cattle occur on feeder areas, all three types of feeders must be protected against loss of food or damage to the feeder by these animals. The garbage-can feeder must be enclosed within a hog-wire fence (normally a triangular enclosure six feet on a side) where hogs occur. A barbed-wire fence will suffice if cattle alone is the problem. The Scruggs feeder is fairly cattle-proof but must be protected from hogs in a manner similar to the one used for the garbage-can type. The shelter type feeder is also cattle-proof but must be anchored to trees or posts to prevent its being turned over or shoved about by hogs. All three feeders are reasonably weatherproof except when rainfall is accompanied by excessively high winds.

The shelter type feeder has one serious disadvantage not shared by the other feeders. This is the development of sour, moldy conditions during wet weather on heavy soils protected from sunlight by the shelter. Special attention must be given to the depth and size of the pipe supporting the Scruggs feeders so that the feeder is rigidly suspended and free to rotate on its orbit when touched by cattle.

Approximate costs of the three types of feeders are as follows:

Garbage can type feeder:

Feeder	$4.00	
Wire for hog fence	1.00	
Posts	.75	
Lumber for braces	.35	
Labor	2.50	
	———	
TOTAL	$8.60	per feeder installed.

Shelter type feeder:

2 x 4 lumber	$1.35	
Metal roofing	2.00	
Barbed wire	.20	
Can for feeder	.15	
Labor	2.50	
	———	
TOTAL	$6.20	per feeder installed

Scruggs feeders:

8 qt. size	$5.00	FOB, Tampa, Fla. Ship-
12 qt. size	$6.50	ping wt. approx. 13 lbs.

Cover Planting

To date no plant has been discovered that is completely satisfactory for quick restoration of cover in Florida. Throughout the Midwest and Northeast multiflora rose has become a standardized plant for cover restoration work. It is used for hedge planting and makes excellent quail cover and a living livestock-proof fence in about five years. The plant is out of its range and does not grow well in Florida.

Planting pines, cedars, or wild plum where desired is fairly effective as a means of cover restoration. Pines will grow throughout the state and a pine planting with its accompanying brushy vegetation will provide suitable escape cover in four or five years if planted in the form of plots or strips. Native weeds, vines, and shrubbery can be encouraged by protection from fire and grazing where additional cover is needed.

In Florida good quail cover is best supplied by the use of good judgment in land clearing operations so that clumps of palmetto or other brush cover are well situated over the land.

Quail Management on Farm Lands

Whether the farmer hunts them or not, quail are an asset. They assist in the control of insects and weed seeds. In addition, most landowners "just like to have them around" to hear and see. Many farmers have friends who hunt and whom they like to invite to their place for a hunt and a visit. If a farmer wishes, he can charge a fee for hunting quail on his land and thereby receive pay for his efforts and expenses incurred in raising and feeding them.

We are entering an era of bargaining between farmer and sportsman. If the bird hunter wishes to continue to have a good place to hunt, he is going to have to pay for it. Human nature being what it is, the farmer who realizes a financial return from his quail is going to make the greatest effort to maintain a good quail population. It is just as proper and fitting that the farmer receive reimbursement for a crop of birds which he has helped produce as for any other

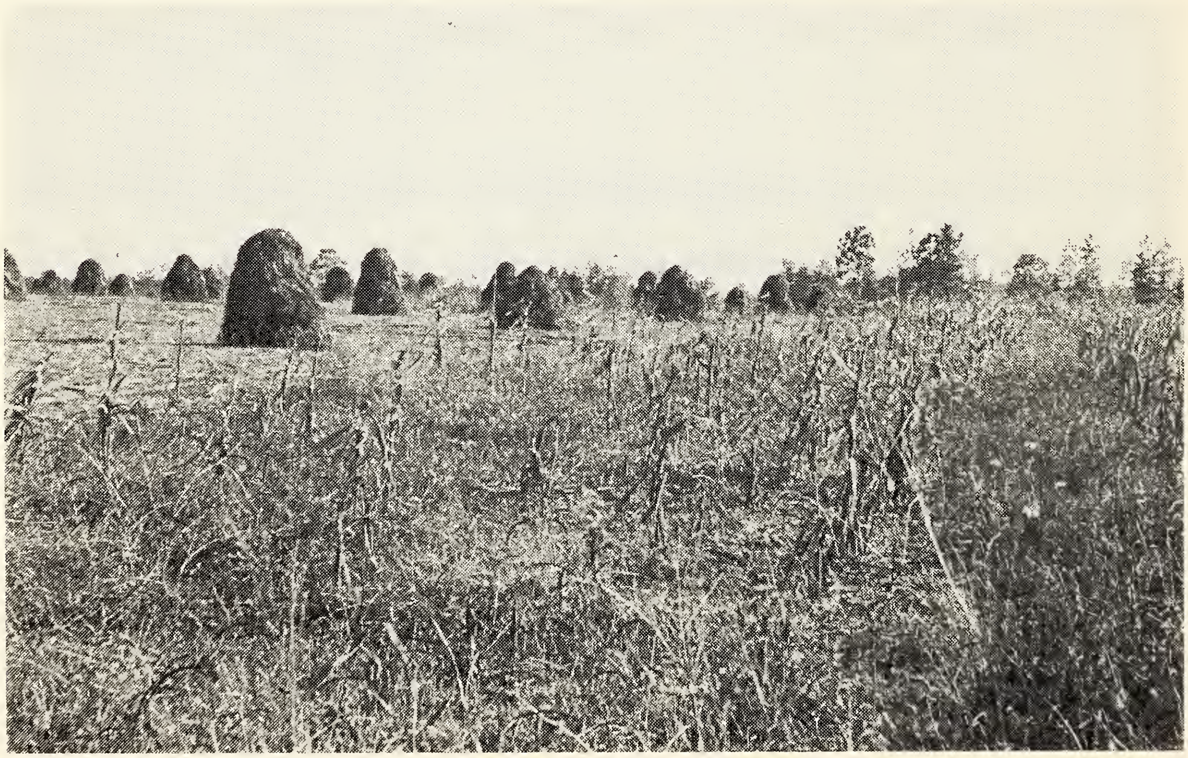

Figure 18. Corn and peanut cropland in northwest Florida provides much quail food.

crop. This payment may be substantial enough to make it well worth his while to raise birds. There is one thing for certain, however, if he is to benefit financially from hunters he must produce something for them to shoot. The only way he can produce a large harvestable quail crop is through proper management of food and cover.

In Florida conventional farming is confined largely to the northern part of the state. Here the majority of landowners depend upon row or cash crops for their income. Crops grown are principally corn, cotton, peanuts, and tobacco. The carrying capacity for quail on these lands is fairly high because of the food that is produced by the crop itself or by weeds and grasses that result from soil disturbance. Corn and peanuts are both important quail foods. A change from a row crop type of agriculture to grazing or tree farming almost invariably results in a reduction in quail.

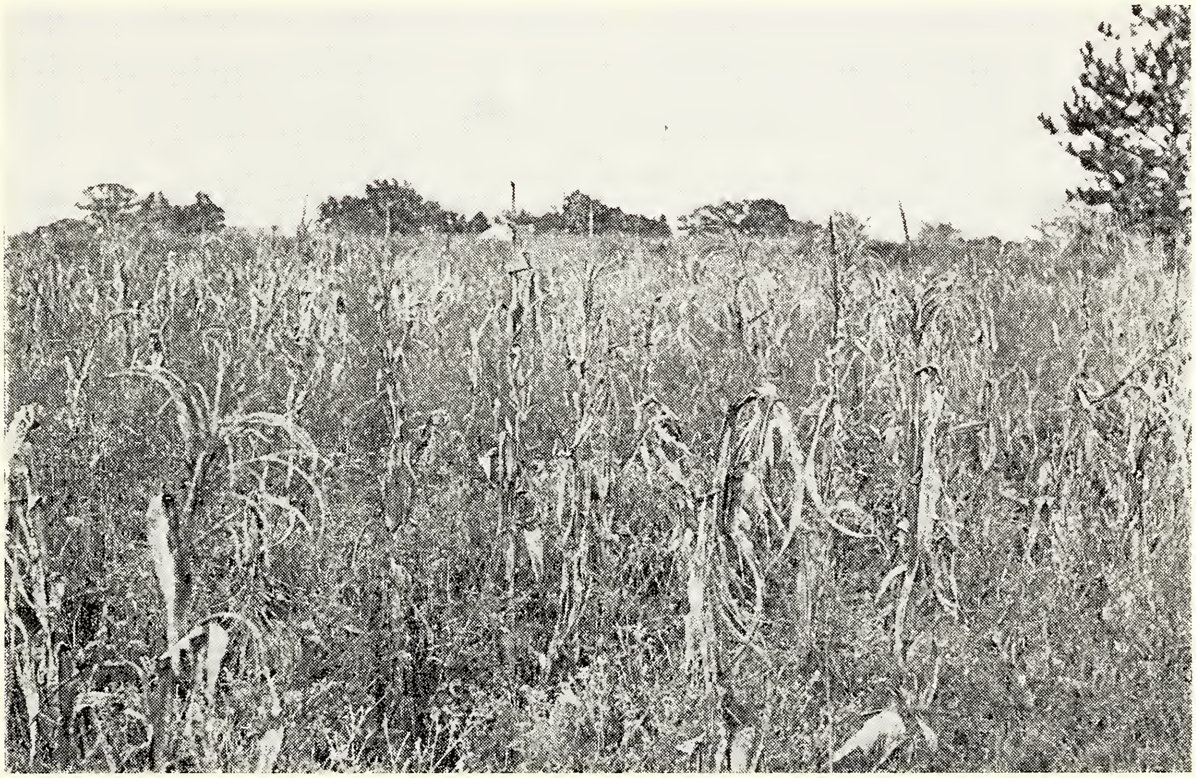

Figure 19. A corn field full of Florida beggarweed is a paradise for quail.

On land cropped to corn and peanuts the best stage of plant succession is the first, or the year that it is cropped. Food is available from the crops themselves as well as the annual weeds and grasses. A cornfield full of beggarweed, watergrass, and ragweed is "quail heaven." It is good quail management to leave along the edge of the field adjacent to cover a couple of rows of corn unharvested or a couple of rows of peanuts turned up but ungathered. On cotton and tobacco land the best stage of succession is the first or second year following cultivation when plants such as partridge peas and paspalum grasses provide food. A cotton or tobacco patch provides little or no food while in cultivation since it is kept free of weeds and grass and no part of either plant can be utilized as food.

The most important management factor on farmlands is the maintenance of proper interspersion or distribution of food and cover. Food and cover should always be in close proximity. Birds will not range so far from cover that they cannot quickly reach it if disturbed. Ordinarily they do not range over about 50 yards from woody cover in their foraging except in good ground cover such as illustrated in Figure 18. Generally speaking, a 40 acre field in cultivation with cover surrounding it is about the maximum sized tract of land that can be cleared and cultivated in one block and still support a fair quail population. Farmland without good patches of escape cover at least every quarter mile cannot support more than a token quail population. In such situations cover has become the limiting factor. In general, the smaller the fields, or the more the landscape is broken up into food and cover areas, the better.

A highly favorable situation is also reached when food and cover grow together on all the land, such as on timberland supporting a good growth of quail food plants with frequent clumps of cover. The encouragement of this condition is a major type of management employed on the game plantations in north-central Florida where quail production is the leading land use.

Although there still remains a fair distribution of food and cover in the northern section of the State, the trend is toward "clean" farming, especially with the cattlemen. Hedge rows and other remnants of cover are "cleaned up" simply for the sake of looks or beautification. Somewhere along the line the idea has been created that a farm that has no brush looks more progressive or prosperous than one that does. It is certainly a misconception to associate clean farming

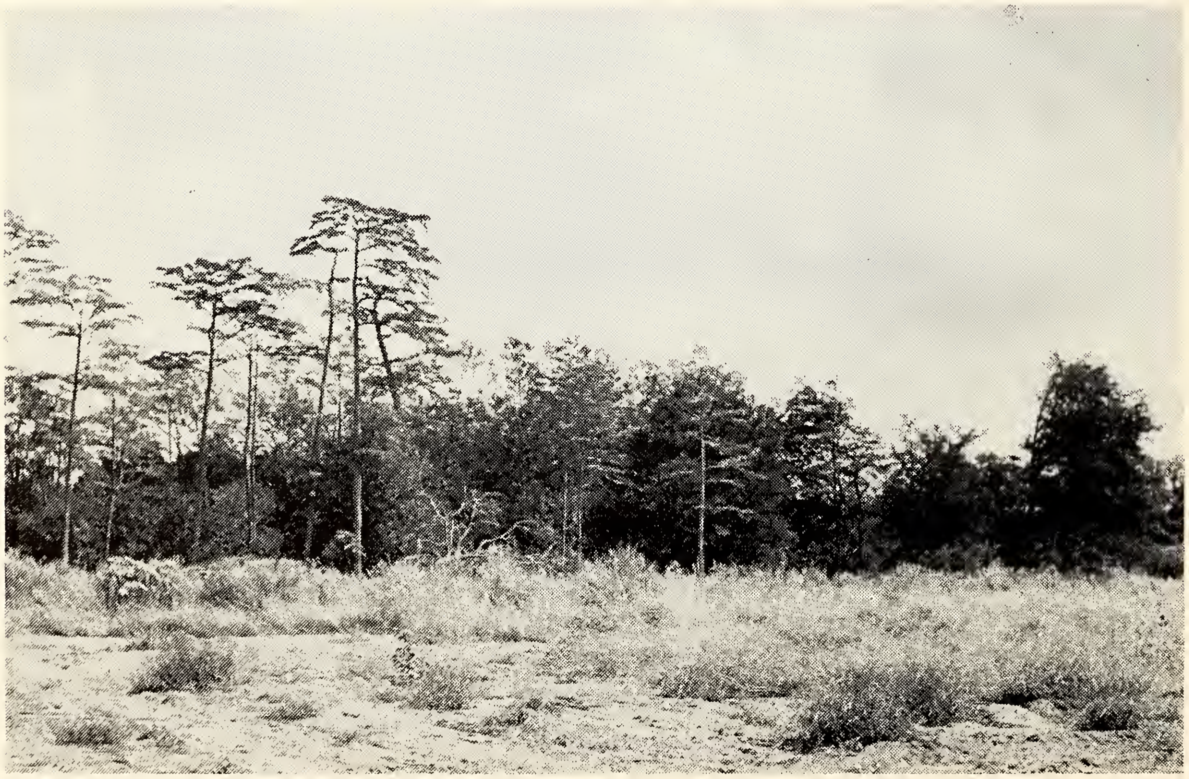

Figure 20. Small cypress ponds provide escape cover.

with prosperous farming. In many cases it costs the land owner more to clean up an area than he will ever realize from it in terms of crops or grasses. A good example of this is the clearing of small cypress ponds, a practice that is progressing in some localities. To bulldoze cypresses and clean the area up is very costly. Another cost involved is in their drainage, because they have to be drained before they will grow crops. Since they are usually only a fraction of an acre in size, it is impossible for the landowner to get his money back. These ponds make good areas of escape cover for birds. On some farms they are the *last* remnants of natural cover; but for the sake of neatness they are yielding to the blade of the bulldozer.

The citrus grove type of agriculture practiced in central and south Florida is another example of land clearing on a wholesale scale. Here the natural vegetation over areas as large as whole townships has been cleared and the land planted to citrus. The practice of clean cultivation that is followed prevents food and ground cover plants from growing. There are large acreages of citrus on land once highly productive of quail where the quail population will not average a bird per 100 acres.

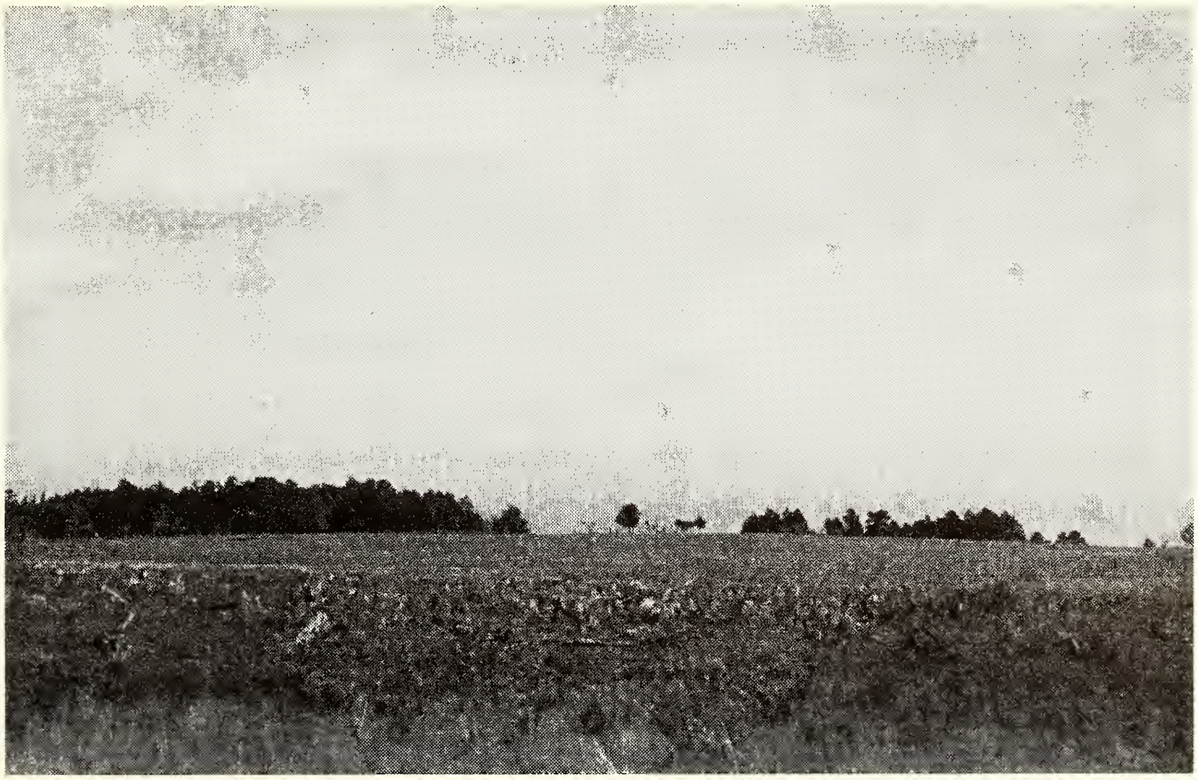

Figure 21. A cypress pond cleared up. This operation costs the quail protective cover and the landowner dollars that he will never realize in return.

Citrus is a $200,000,000 per year industry in Florida. Cleared grove land may sell for as much as $1,000 per acre without a tree planted on it. In view of this it is not difficult to understand the grove owner's reluctance to utilize any of this land for wildlife. Under such circumstances quail can be nothing more than an incidental crop. Perhaps some day a program can be worked out with grove owners that will be of mutual benefit to both grove and quail, but it is doubtful. Even if the groves were carrying a quail population of a bird per acre, they could not be shot or harvested because of shot damage to the fruit. So, there will never be much hunting value derived from grove quail. Aesthetic values and the destruction of harmful insects are about the only values these birds have to the landowner. These rank extremely low in dollars and cents when compared with his fruit.

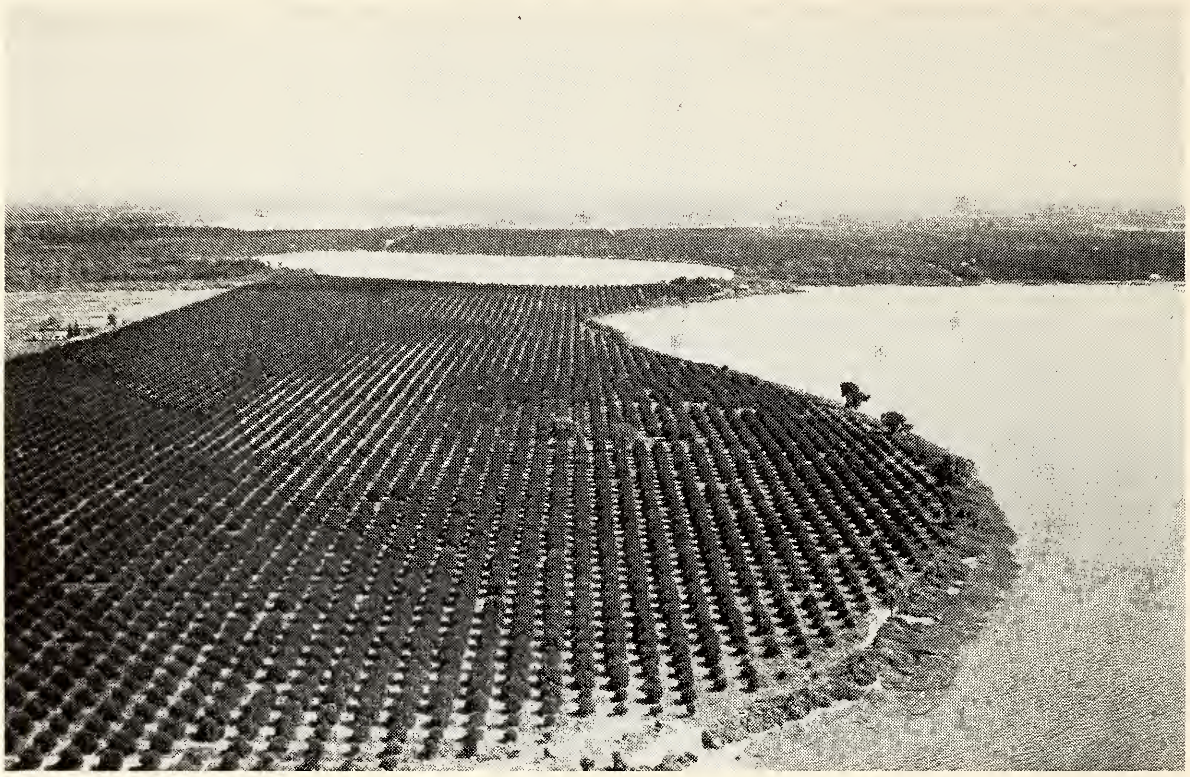

Figure 22. Grove country—poor quail country.

Quail Management on Woodlands

Contrary to the situation on farm lands, the principal quail management problem on woodlands is that of supplying adequate food. There is normally too much rather than too little cover. All three of the previously discussed food production techniques — planting, encouragement of native vegetation, and use of feeders — can be applied on woodlands. Food planting is most practical on woodlands not subject to grazing. Feeders are most satisfactory for heavily grazed areas — particularly in south Florida. In either case the proper density of trees and ground cover must be maintained to permit free movement of birds and growth of native plants. Where quail management is of concern on lands devoted primarily to timber production, care must be taken to keep the stand sufficiently open to permit growth of ground vegetation and to permit hunting. A pine forest is as much a desert for quail as a clean pasture as long as the trees and ground vegetation are so dense that quail food plants are crowded out and free movement of birds is prevented. The density of trees can be controlled by selective cutting. Density of ground vegetation and encouragement of quail food plants can be achieved by discing or prescribed burning.

Prescribed burning is becoming a standard practice in modern forestry management. By periodic burning to control a heavy accumulation of "rough" serious fire losses can frequently be prevented. Fires that break out in woods where there is a heavy rough accumulation often result in a nearly complete loss of timber. Prescribed burning is employed in timber management also when natural seeding is desired. Fire scarifies the seed and makes it possible for them to make contact with the soil where they germinate. Prescribed burning also helps control brown spot disease in longleaf pine stands. It may be desirable to burn or disc on a strip-rotation basis where pine reseeding is a factor. A four-year rotation cycle can be employed easily providing the young seedlings have made satisfactory growth.

It is advisable in many instances to supplement the native foods in woodlands by planting food plots. This is particularly true where timber or pulpwood management is of primary concern and the woods cannot be burned or disced

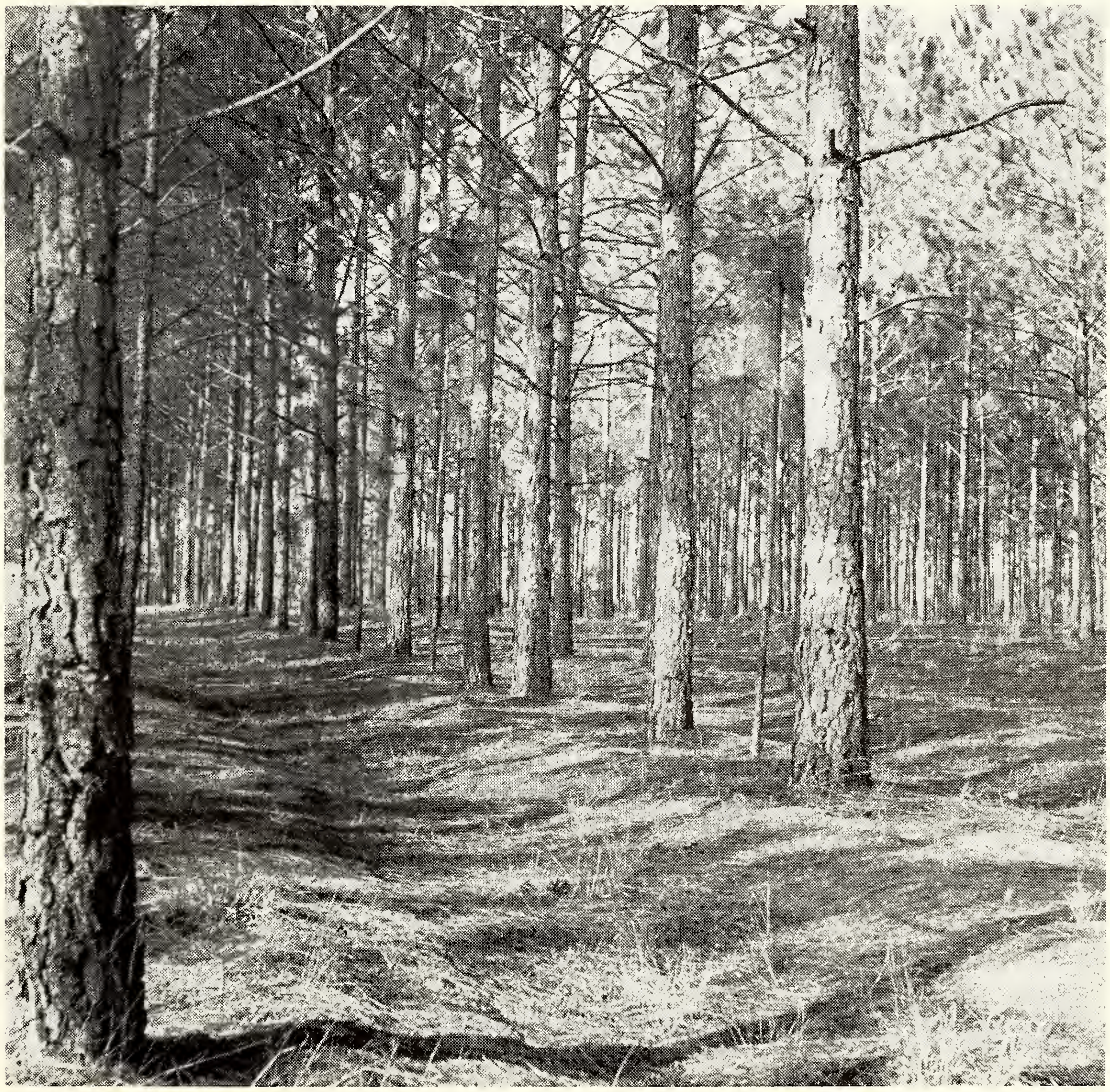

Figure 23. A planted pine forest—desert for quail. Note absence of ground vegetation.

annually. This practice also has the feature of locating the birds where they are readily available to the hunter. Instead of hunting the entire woods he can hunt from plot to plot and his hunting success will be much higher per unit of time and effort. On some preserves with an extensive woodland food planting program, bird dogs learn that game is found only at the plots. They race from plot to plot and refuse to hunt land lying between them.

A woodland food plot should be around an eighth acre in size, but can be any shape and dimension. A plot in the form of a strip 400 or 500 feet long winding between the trees is the conventional type of planting. Where fencing against cattle is necessary, it is more economical to have the plot as nearly square as possible. This often involves the clearing of a little land. The initial cost per plot where fencing is necessary will usually run around thirty or forty dollars. However the cost diminishes in successive years after the fence has once been constructed.

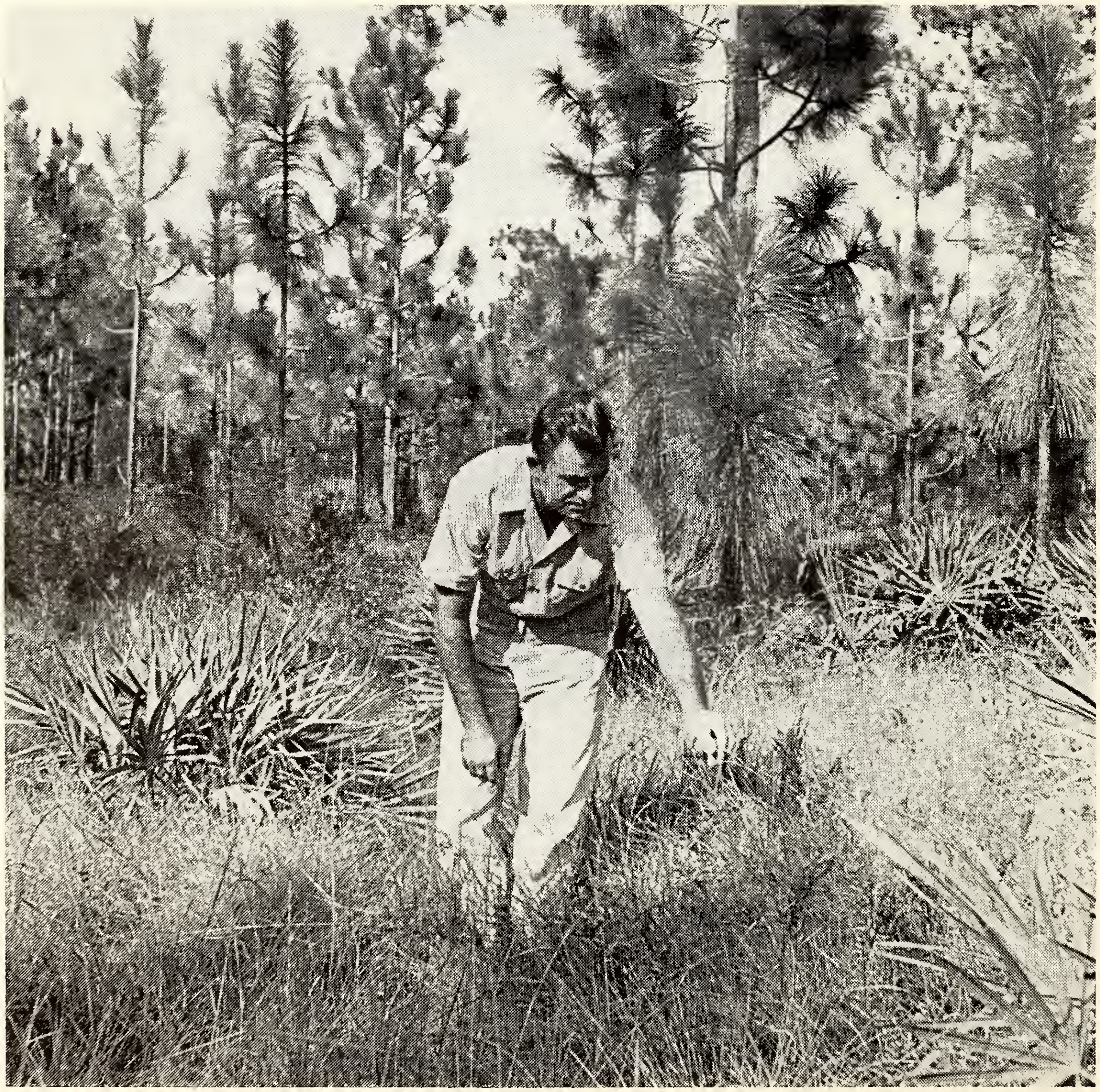

Figure 24. "Rough" accumulation has become such in these woods that they will not support quail and a fire hazard is present. A wild fire could seriously damage this stand of pines.

Instructions for planting the woodland plot are the same as for those already discussed. Site selection in relation to moisture conditions is of paramount importance in woodlands. Land that grows gallberries is usually too wet. Conversely, land that grows turkey oaks or "blackjacks" is usually too dry. In rolling country the strip of land lying between these two zones should have the right moisture content. This intermediate zone is usually characterized by the presence of runner oaks. This plant is such a good index species of proper moisture conditions that the operator can merely ride through the woods and pick sites for his plots by looking for runner oaks. Food plots should be interspersed as regularly as possible throughout the woods. Where a rather intensive program is desired, there should be a plot for every twenty acres of land.

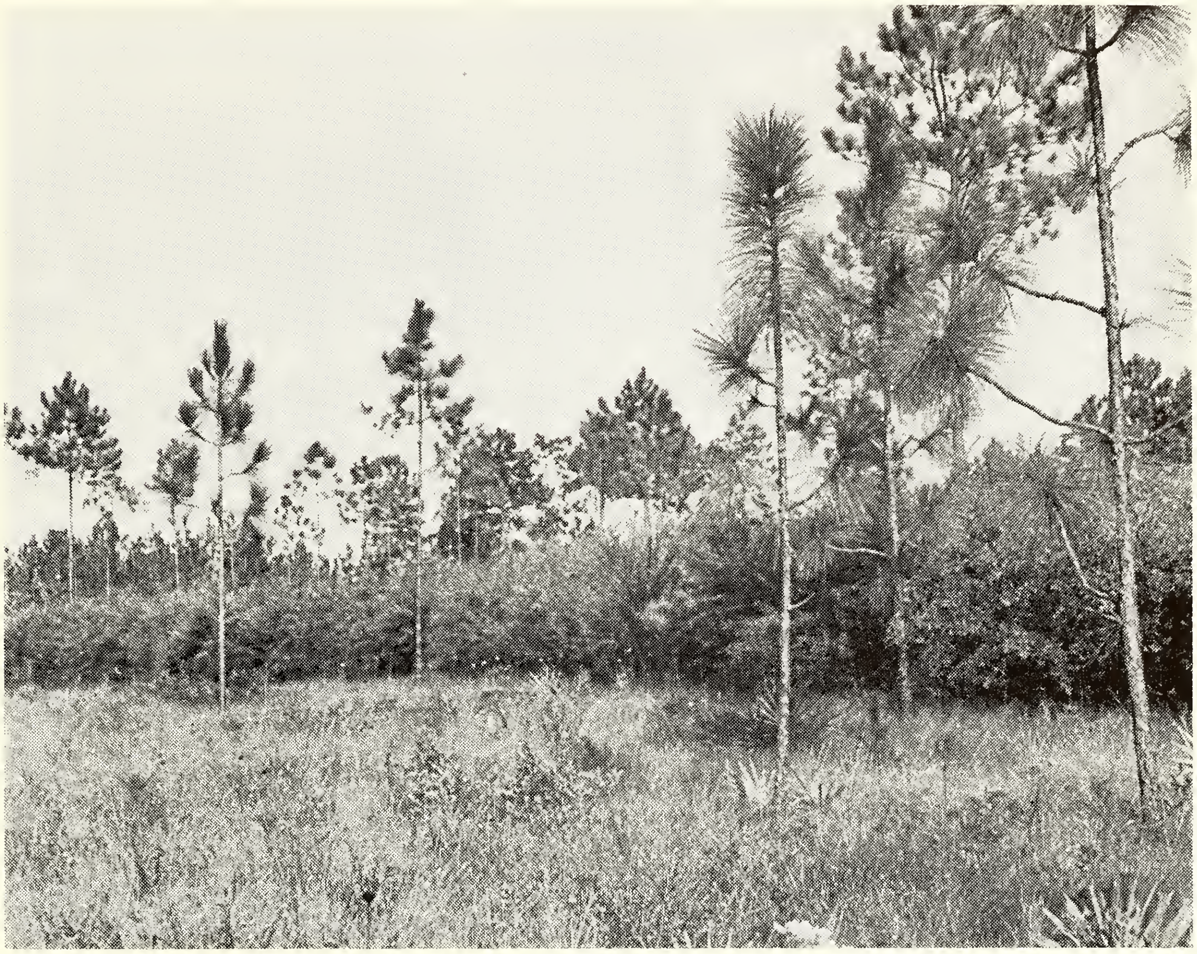

Figure 25. A woodland planting of thunbergii lespedeza.

Power lines that traverse woodlands create excellent opportunities for food plantings. The establishment of plantings beneath the lines is wise land use since this land is out of production for timber. Since the power company has cleared the land, the operation just involves plowing, fertilizing, and planting. Plantings made here are out of the way and do not interfere with other timber operations. Most power companies welcome such use of their land as it cuts down on their right-of-way maintenance activities.

Feeders are useful as a seasonal supplement to food plots. The plot serves more or less as a covey headquarters with the feeders supplying high quality food at least during a portion of the year.

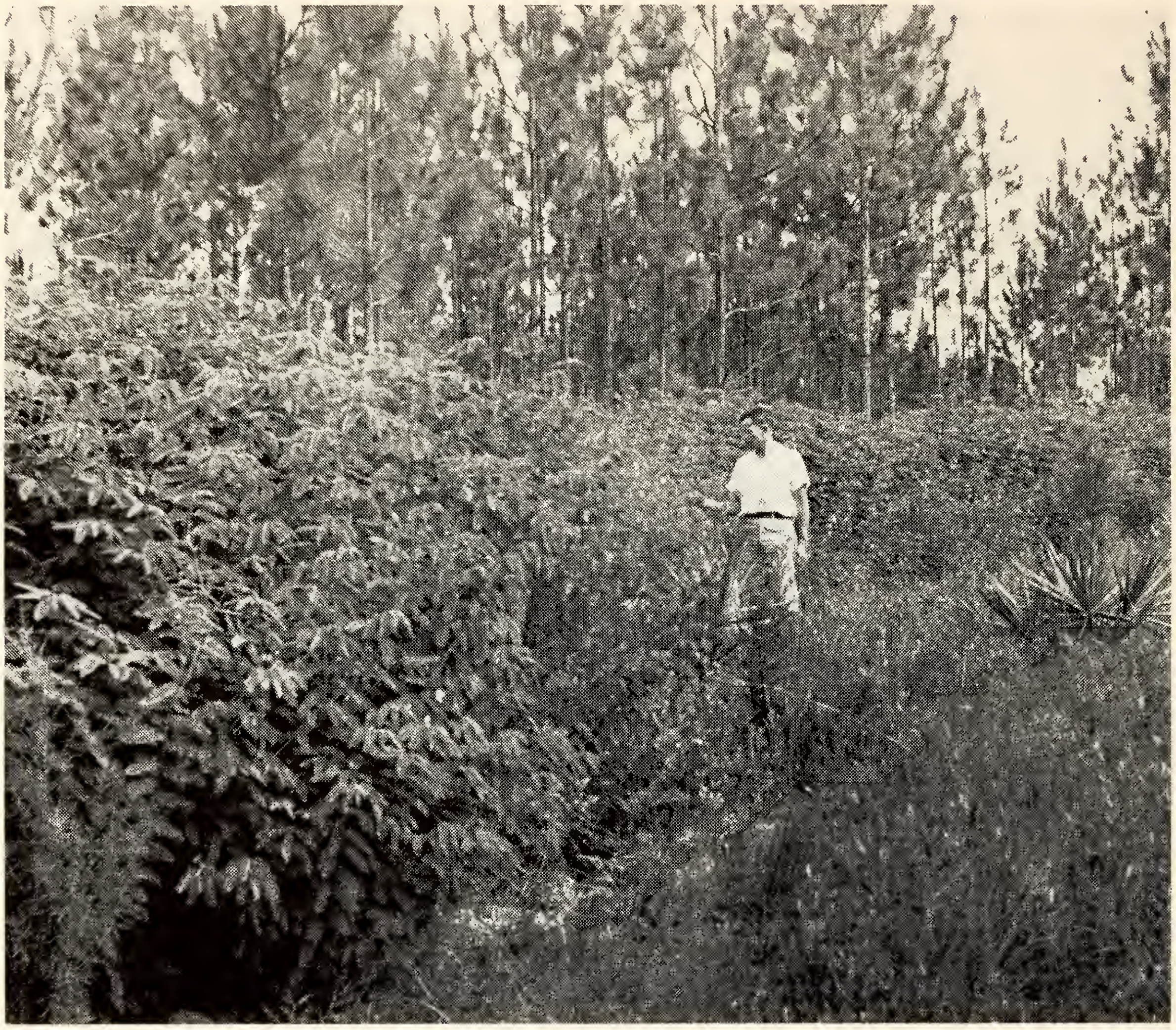

Figure 26. A woodland planting of giant partridge peas.

Quail Management on Grazing Lands

The management of most grazing lands so that they will carry a fair quail population requires thought and planning. Generally speaking, cows and quail don't harmonize except in the open grazing lands of south Florida. In the northern part of the state, cattle selectively graze the legumenous and other food plants of particular importance to quail. Similarly, their grazing activities help to reduce the cover that in many instances is the critical factor in their survival. In the palmetto flatwoods of south Florida this situation does not exist because the nature of the vegetation is such that the most important quail food plants are not particularly palatable to or seriously damaged by cattle. Also the excellent cover furnished by palmetto clumps is not damaged by cattle.

The principal damage to quail by the cattle industry in south Florida lies in the clearing of large acreage for improved pastures thus rendering all except

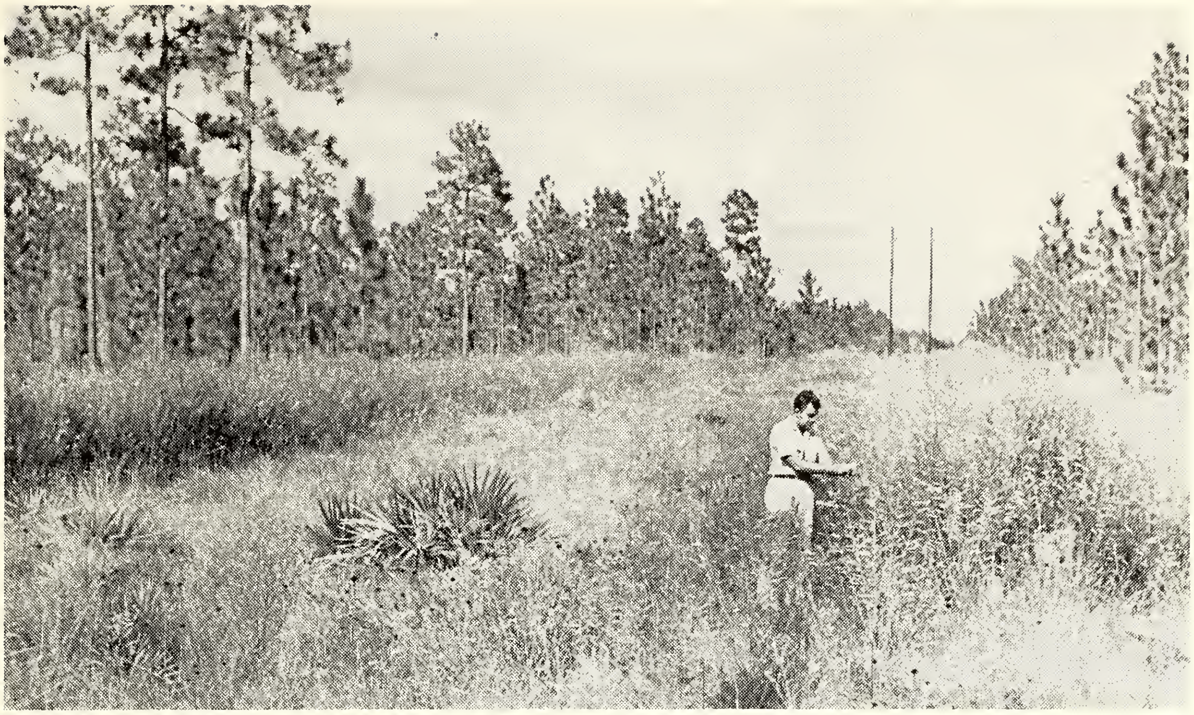

Figure 27. Partridge pea plantings beneath a power line. These rights-of-way lend themselves beautifully to food plantings.

the margins of such areas uninhabitable by quail. Modification of standard pasture improvement practices so that frequent patches or strips of cover are left can probably offset a great deal of the damage to quail habitat.

One system that is being suggested to cattlemen interested in quail and that is being applied on an experimental scale on the Cecil M. Webb Wildlife Management Area consists of improving pasture in long strips of from 50 to 100 yards wide interspersed with strips of natural vegetation of similar width. Alternate natural vegetation strips can then be burned in alternate years to give maximum benefits to both quail and cattle. There is no question that such a technique would be superior to solid pasture improvement from a quail standpoint and might, because of certain beneficial effects of fertilizing and surface drainage in pasture preparation, constitute an improvement over natural quail habitat.

There are, of course, a number of factors to be considered from the cattleman's standpoint. It appears that the principal additional cost of strip pasture improvement would be additional fence. The greater area enclosed per unit of pasture being improved would increase the amount of fence by about one third. Possibly compensating for this additional cost are benefits attributable, according to some cattlemen, to the ready availability to cattle of both improved pasture and native vegetation. Also worthy of consideration is the saving resulting from simply pushing palmetto roots and other woody material onto the unimproved land and thus avoiding the cost of disposing of it.

Another reasonably effective and inexpensive method of improving pasture with the least possible damage to quail habitat involves simply plowing around instead of destroying the larger palmetto and other cover clumps. This would considerably reduce the cost of the clearing operation, would permit the maintenance of quail population, and would be detrimental chiefly to the dubious ideal of "clean" farming. The practice of leaving palmetto and other rough would not be practical in the extremely intensive type of pasture improvement that will permit mowing. In much of south Florida such intensive pasture improvement involving the movement of dead wood, stumps, palmetto roots and other impediments is not economically feasible.

The two principal grasses used for pasture improvement in north Florida are Pensacola bahia and coastal bermuda. In central and south Florida pangola is also an important pasture grass. Unfortunately only bahia of these three principal grasses has any value for quail. White Dutch or ladino, and crimson clover are pasture clovers whose leaves are of considerable value to quail in late winter and early spring particularly in north Florida.

Even though intensive cattle production is the land use in Florida probably least compatible with quail management, quail and cattle can be produced together. Very frequently cattlemen are ardent quail hunters who also wish to grow quail. They can have both with a little planning. On unimproved pastures there is quite often sufficient cover for birds. The principal shortage is food. Food can be provided by the establishment of food plots or automatic feeders. Plots are most useful in north Florida, feeders in south Florida. Either should be located near a good clump or thicket of cover and protected from livestock. Some practices of managing unimproved pastures such as prescribed burning for better grazing may also be beneficial to quail.

The proper use of fire probably constitutes the most practical quail management technique applicable to south Florida flatwoods. As previously discussed in detail in the section dealing with the effect of fire on vegetation, fire is of principal benefit to quail through its temporary suppression of perennial vegetation to the advantage of the annuals which constitute the most important quail foods.

Fall and winter burning is of most benefit to quail in south Florida flatwoods. Fortunately burning at this season rather than in the late spring and summer is becoming recognized by most cattlemen as most beneficial to cattle. As a result, late spring or summer burning is seldom used by the better informed cattlemen except in extreme emergencies. The immediate need for the new grass following such a burn must outweigh the disadvantage of not being able to burn the following fall because of insufficient buildup of combustible materials. Fall and winter burning results in the production of maximum cattle forage and also produces tender young grass in the winter and early spring, at which time it is most needed.

There are two distinct burning techniques for the most satisfactory and least damaging burns in south Florida where the aim is to burn over approximately half the land each year. One of these consists of burning under low wind conditions to produce a slow, creeping fire. The other entails burning under high wind conditions to produce a fire that sweeps through the top portion of the vegetation so rapidly that enough heat to damage pines and other beneficial vegetation is never generated. A fire under such conditions is frequently extinguished on the sides resulting in long narrow burns ideal as fire breaks. The low wind technique is probably best suited and is least dangerous for low moisture conditions. Probably the safest is a high wind fire under moisture conditions so high that a stiff breeze is necessary for any fire at all. Less wind will allow the fire to die and more wind will either blow it out or merely move the fire along faster to accentuate the good qualities of the high wind fire. Low moisture conditions create a hazard with either technique since a reduction in wind velocities when the high wind technique is used or an acceleration when the low wind technique is used can result in a harmful fire. This further emphasizes the desirability of burning a large part of the area to be burned as early as possible so that these earlier burns will stop later fires that may get out of hand.

Theoretically, frequent small burns would be of most benefit to quail since they would in effect create more "edges" and would permit the utilization by quail of the entire area at all times. Quail invariably move from large clear burns and use only the edge of the burn until the vegetation grows back. Their repopulation of such an area is comparatively rapid and it may be that the temporary non-use by quail of an area is not as important as superficially appears. Nevertheless, smaller and more frequent burns are definitely recommended not only from the quail standpoint but from the standpoint of fire control.

The density of the ground vegetation has a great deal to do with the intensity of a fire. Grazing is particularly important as a factor determining this density. It operates principally by keeping wiregrass cut back during the period of its greatest growth in the spring. Grazing also contributes to the overall year round reduction of vegetative cover.

Probably the best general system of burning to improve conditions for both cattle and quail in south Florida flatwoods involves burning half the total area each year. Slightly more than half the burns should be made as early after October 1 as possible and the others made prior to the end of February. Burning locations should be so selected that early burns are spaced at intervals throughout the entire pasture under management to serve as fire breaks. Moisture conditions should be as high as possible, regardless of the season.

In clearing pasture land where a certain amount of cover is left for birds, mast producting trees such as live oaks, wild cherries, sweet gums, and dogwoods should be left nearby for food when possible. Wax myrtle bushes provide an abundance of food and also cover. As many of them should be left as possible.

There are two plants, common lespedeza and alyce clover *(Alysicarpus vaginalis)*, that can be sown in conjunction with grasses that are particularly valuable for both pasture and quail food under conservative grazing. Common lespedeza is useful in heavy soils of north Florida. Alyce clover is better adapted for the sandy soils farther south. Both produce abundant seed relished by quail.

About all that can be done to restore quail to improved pasture is to plant tracts or strips to suitable brushy cover plants. Alhough it will involve waiting a few years for the plants to grow to the size to provide cover, it is the only means of cover restoration. Once it has become reestablished food can be provided by plantings or feeders. It should be emphasized again that the most practical way to have a joint quail and pasture management program is to work from the beginning with the land clearing operation in leaving a certain amount of cover and food in strategic places. Here, truly, "an ounce of prevention is worth a pound of cure."

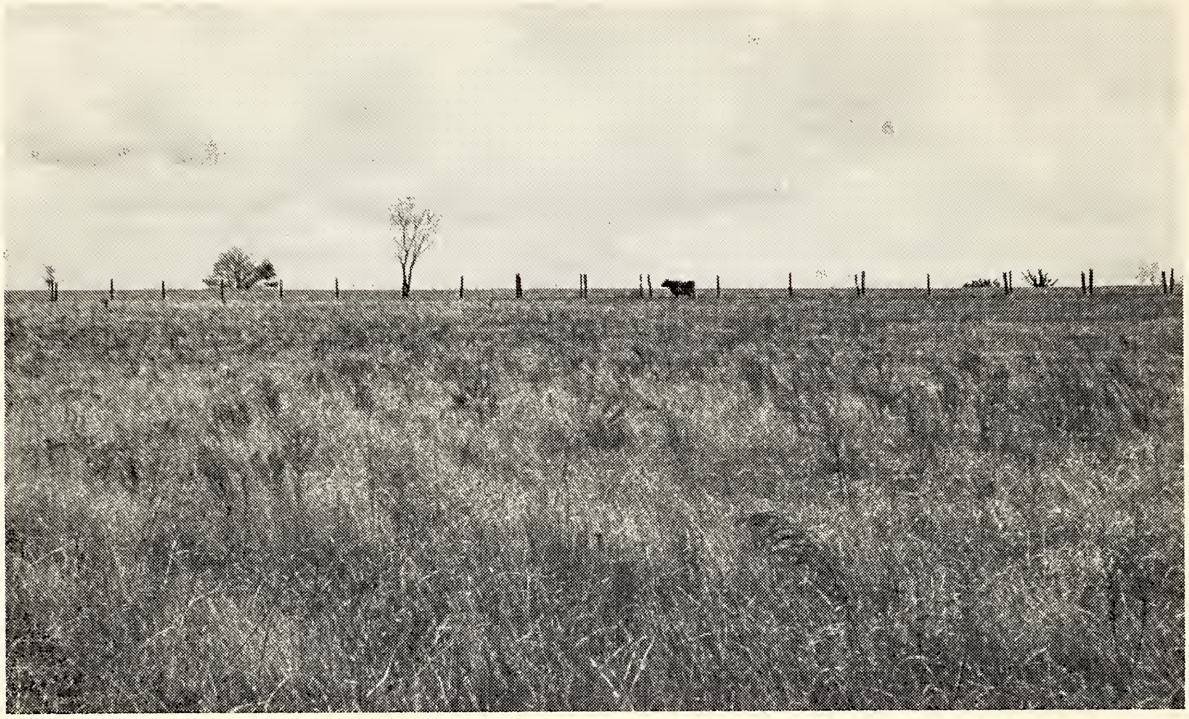

Figure 28. A Florida improved pasture—also a quail desert.

SUMMARY

The bobwhite quail, Florida's number one game bird, is found in every county of the state wherever suitable habitat occurs. The south Florida bobwhite is approximately one fifth smaller and noticeably darker in coloration than its north Florida counterpart. The bobwhite is extremely prolific — laying a clutch of fourteen eggs on the average. Only one brood is produced per year but pairs will renest throughout the summer if earlier nesting attempts fail. The young reach maturity in approximately 15 weeks. As a rule, from 70 to 80 percent of a quail population is composed of young of the year regardless of whether or not the population is hunted. The bobwhite has many natural enemies as well as the hunter which annually take their toll. However, quality of habitat and weather conditions rather than hunting or predation are the factors normally determining quail abundance.

The sport of quail hunting is becoming more and more difficult to maintain as Florida's human population increases and demands are made for more intensive use of the land for forestry, agriculture, and grazing. If the sport is to continue, the remaining suitable lands must be managed more intensively for quail. The key to quail abundance is proper distribution of high quality food and cover.

On the three principal types of land suitable for quail, practical steps toward good quail management are as follows:

Farm Lands:

1. Leave cover in fence rows and at other strategic places.
2. Lay crops by early.
3. Delay turning stock into corn fields as long as possible.
4. Plant food plots on field borders and other suitable places.

Forest Lands:

1. Maintain an open timber stand to permit growth of ground vegetation.
2. Maintain proper cover density and encourage natural food production by prescribed burning and discing.
3. Establish food plots at regular intervals.
4. Supplement natural foods and food plots with automatic feeders.

Grazing Lands:

1. Avoid removal of natural cover from large continuous acreages. In south Florida grazing lands, frequent areas of palmetto clumps or other brushy vegetation should be left in pasture improvement programs.
2. Use prescribed burning during the fall and winter to improve grazing on native pastures and to encourage native food plants.
3. Leave cover in fence rows.
4. Supplement natural foods with automatic feeders — especially in south Florida; and with fenced food plots — especially in north Florida.

Practical quail management is a reality. Its application rests principally, but not solely, with the landowner. He must be assisted and encouraged financially and in other ways by the sportsman if he is to be expected to devote time and effort to increasing quail. There must be community effort and mutual understanding of each others problems between landowner, sportsmen, and conservation groups and agencies if quail hunting is to survive as a sport for the average man.

APPENDIX

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